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MONOGRAPH OF THE LARRIDÆ OF KANSAS..... *Francis X. Williams*

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THE KANSAS UNIVERSITY SCIENCE BULLETIN.

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The Larridæ of Kansas.

BY FRANCIS X. WILLIAMS.

(Submitted in partial fulfillment of the requirements for the degree of Master of Arts at the University of Kansas.)

Plates XXII to XXX.

INTRODUCTION.

THIS paper is the result of about two years of study on that group of insect-catching wasps known as the Larridæ. The work done embraces the field observations and collections of three consecutive summers (1910-'12), spent chiefly in the western portion of Kansas; a large amount of laboratory work at the University; and a trip to the United States National Museum and Philadelphia Academy of Sciences during the winter of 1912-'13.

It may be here stated that the Larridæ belong to the order Hymenoptera, and constitute one of the families of a large series of wasps known as the Fossores, or *digger wasps*, so named because of their habit of excavating burrows in the earth. The Fossores in turn are included in and form the largest portion of that great assemblage, the *solitary wasps*. These are distinguished from their *social* brethren by having the species represented only by the male and the fully developed female, whereas the latter group possesses three castes or forms—males, egg-laying females, and undeveloped females, or workers. Furthermore, each female solitary wasp constructs and uses her own nest, unless parasitic, while social wasps have one common abode, and are therefore of communal habit.

The Larridæ are rather stoutly built insects, for the most part of somber coloration, and, in the United States, range from about one-eighth of an inch to nearly an inch in length. Being very swift of movement and inobtrusive in habit, they are seldom seen by the the casual observer. Generally speaking, they store their burrows with long- or short-horned grasshoppers, crickets, and bugs, which are subdued by stinging. The wasp lays an egg in each provisioned cell, closes it, and then leaves her offspring to work out its own salvation in this dark chamber. Upon hatching, the grub devours the food provided (this is often in a decomposing condition), and reaches maturity, to spin or form a sort of cocoon. From this cocoon the wasp emerges in due season, to continue the life-cycle.

Those of us who have not had the good fortune, the patience or the inclination to watch one of these digger wasps at work have missed the opportunity of observing an insect of remarkable instincts, great perseverance, and notable temerity in attacking its often huge prey. Few persons have any idea of the vast amount of good done by these Hymenoptera, for the noxious insects destroyed by the solitary wasps is very great, and plays an important part in maintaining the balance in nature.

The external anatomy of the large species, *Tachytes distinctus*, which is worked out in this paper, has presented features of interest to the writer, while the classification of the group, because of its ill-defined limits and the close relationship which many of the species (of which fifty-eight have been found in Kansas) bear to one another, is rendered at the same time both attractive and perplexing.

This paper is of necessity far from complete, particularly so is the chapter devoted to biology; nor can the writer hope that it is free from errors.

The identifications have been made with care, and if the status of a species is uncertain it is so indicated in the text. The types of the new species are in the Snow entomological collections, at Kansas University, at Lawrence.

While in most cases the keys are largely modifications of those of Sharp, Cresson, Fox, Ashmead, and others, the writer frequently emphasizes characters heretofore but little used in classification in the American keys to species, so that this portion of the work is not lacking in originality. The generic and often the specific descriptions are in a great measure

taken from those in Fox's "North American Larridæ" (Proc. Acad. Nat. Sci. Phil., 1893). These are usually abridged, except in the case of new species, and often refer more particularly to the Kansas specimens.

No attempt has been made to cite much of the literature relating either directly or indirectly to the Larridæ. This is largely because of the inaccessibility of many of these writings, chiefly those of Europe, which are very important, and because of the limited scope of this paper. In the systematic portion reference is made to the original descriptions, and very frequently also to the best or more accessible diagnoses. The drawings are original, often of camera lucida outline, and where possible are made from the type specimen.

In conclusion I desire to extend my thanks to the various members of the Kansas University Entomological Survey who assisted me in the field work; to the officers of the United States National Museum, for the favors extended me while there, especially to Mr. S. A. Rohwer, of that institution, for the very efficient aid given me in identifying species, etc.; to the Academy of Natural Sciences of Philadelphia, for similar kindness, and in particular to Mr. Wm. J. Fox, for copying portions of literature inaccessible to me, and for comparing specimens; to Prof. Myron H. Swenk, of Nebraska University, for the loan of certain Larridæ; to Mr. H. B. Hungerford, of Kansas University, for criticizing the manuscript; and finally to Prof. S. J. Hunter, in whose department this work was done, for many helpful suggestions and for his patience and criticism in going over the manuscript.

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March 13, 1913.

PART I.

The External Anatomy of *Tachytes distinctus.*

Inasmuch as the external anatomy of each genus of the North American Larridæ could not be examined, the writer has selected a large and common species, *Tachytes distinctus*, a typical example of the family, as the basis for the short study herewith presented.

The female of this insect is fully twice as large as our common honey-bee (*Apis mellifica*), of stout build, though rather elongate, and in general of a dull black color, partly concealed by pubescence. The yellowish wings are smoky apically; the legs spinose, and largely of a ferruginous color. The male is smaller, and usually more slender than the female. A specific description of the insect will be found in the systematic portion of this paper, while notes on its habits are given on pages 194-197 (96-101) of the biologic section.

In order to bring to light more clearly the often none-too-well defined areas and sclerites, the pubescence and pile should be removed from the head and thorax of the insect.

Head.

(Pl. XXII, fig. 6, front view.)

Areas and Selerites.

The head of this type of insect does not present the comparatively generalized condition to be found in the cockroach, for example, where some of the sclerites are definitely bounded by sutures. On the other hand, they have very largely disappeared by fusion with one another.

Compound Eyes. The large, greenish compound eyes converge towards the upper portion (vertex) of the head, with the effect of making the interocular space at that point only about one-half as wide as the space between the eyes at the base of the mandibles, to which they nearly extend. This interocular space at the vertex varies in different species, and is for that reason of considerable taxonomic value.

Clypeus. This sclerite occupies the lower portion of the face below the insertion of the antennæ. Its area is indicated by *c* in the figure. Its free (distal) end is prolonged into a lobe, from beneath which depends the labrum (*l*). The boundary between the clypeus and the frons, the next sclerite above, is indicated by a suture, which, extending obliquely upwards from near the base of the compound eyes, proceeds first to the outer side of the antennal sockets, then obliquely downwards to just below the latter, and finally transversely before them. The angle thus formed by these oblique sutures is marked by a small pit, the base of the hollow ingrowth of each mesocephalic pillar or arm of the tentorium, which constitutes the endoskeleton of the head.

Frons. The frons, or front, (*f*) as we have just seen, is bounded definitely below by a suture, but its upper limits are quite disputable, for here it can hardly be said to do more than to give way to the vertex, since the suture between these two areas is obsolete or nearly so. The frons is of course bounded laterally by the compound eyes; it bears the antennæ, and perhaps the anterior ocellus, at least. The sockets into which the antennæ fit are quite proximate; there is a short raised area immediately above them, while laterad of this elevation are the two rather large, smooth antennal fossæ or depressions. There is an interrupted line extending from the upper portion of the head to near the antennal sockets. This is the median line of the head.

Vertex. The vertex is defined in Smith's Glossary of Terms Used in Entomology as "the top of the head between the eyes, front and occiput; in bees that part adjacent to and occupied by the ocelli." If, at least in the more specialized families of Hymenoptera, as the one under consideration, the vertex is to be regarded solely as an area of position, it would occupy the top of the head, as the name would imply, and this, at least in most Larridæ, would place the lower boundary of the vertex about at the top of the paired (posterior) ocelli. Regarding the vertex as a sclerite, we would find in certain Hymenoptera that the median impressed line of the frons often forks at or just before the anterior ocellus, but these branches do not extend laterally to the compound eyes, and thus would not shut off the upwards-extending frons (?) from the vertex. According to Comstock and Kochi (Am. Nat., XXXVI, 28;

1902) we read that, "in the more specialized orders, wherever we have been able to distinguish between the front and the vertex, we have found the paired ocelli in the vertex." The solid line *f*, figure 6, probably represents the upper limit (on the median line) of the frons and the lower limit of the vertex (*vx*), from a morphological point of view, while the paired dotted lines *f* and *vx*, in the same figure, represent these two areas as frequently considered by the systematist. Behind the paired ocelli is a somewhat wedge-shaped depression pointing posteriorly. This may mark the posterior limit of the vertex. This depression is well marked in those genera among the Larridæ having the posterior ocelli distorted, and is apparently associated with that distortion.

Genæ and Occiput. The genæ, or cheeks, refer to that portion of the head behind the compound eyes, and limited posteriorly by the occipital ridge. The occiput is represented by a more or less circular depression* occupying the posterior portion of the head and opening into the foramen magnum, which is the passage for the esophagus, trachæ, etc., from the thorax into the head. It is evident from descriptions of species, and from generic descriptions as well, that at least the dorsal portion of the occiput is not usually considered as confined by the raised line bounding the depression, but that it extends more anteriorly, *viz.*, as far as the line drawn from the posterior borders of the eyes, to meet the vertex.

Ocelli. These are three in number, but in *Tachytes*, as in other typical Larridæ, only the anterior one is rounded, perfect, and presumably functional; the posterior ocelli in the species under consideration are drawn out and curved hook-like behind, where they are quite proximate. A smooth, shining area extends along the outer edge of the attenuated ocelli but does not seem to be a portion thereof, for if the part of the head containing the ocelli be submitted to the caustic action of KOH, and then exposed to light, the nearly circular outline for the anterior ocellus is revealed, while the posterior pair show elongate, imperfectly S-shaped slits.

Appendages.

Antennæ. (Pl. XXVI, fig. 41.) The antennæ, as heretofore noted, arise close together from the frons, just above the clypeus. They consist in the male of thirteen joints, and in the

* This is referred to in Say's American Entomology as the jugulum.

female of twelve. They are conveniently divided into three parts: the scape (*s*), the largest and stoutest of the joints, which is differentiated into a small bulbous basal portion (*b*), fitting snugly into the socket, and the main limb, which is quite densely hairy; the pedicel (*p*), a short joint springing from the scape; and lastly, the flagellum or filament *F*, constituting the remaining many-jointed and commonly uniform portion.

Mouth Parts.

(Pl. XXIII, figs. 7-10.)

The large oral cavity bears the complicated type of mouth parts found in most Hymenoptera. If we consider the clypeus to be the dorsal (upper) edge of the oral cavity, we have depending therefrom, though but little exserted, the labrum. This is indistinctly bilobed, and bears some short, stout bristles. From the ventral (opposite or lower) side of the oral cavity hang the cardines of the maxillæ (fig. 7, *C*), contributing to and supporting the latter, which may in turn partly enclose and protect the median composite labium, or lower lip. The latter, unlike the maxillæ, is not directly secured to the head skeleton, but is separated from it by an intervening membrane.

Epipharynx. (Pl. XXIII, figs. 8 and 10, *EPH.*) The epipharynx is a slightly bilobed and pilose membrane which hangs down from the base of the labrum. Laterally it is protected by a thin, weakly chitinized plate, which extends for a short distance into the mouth opening. The epipharynx may be termed the roof of the mouth. At the pharyngeal entrance is the pharyngeal plate, which is opposite the epipharynx. It is a transverse chitinized piece, extending from each side anteriorly as a pair of broader subparallel portions, and posteriorly as a narrow pair (fig. 10, r), which converges to the œsophagus. These (*r*) are termed by Sharp the epipharyngeal sclerites. The piece *s*, figures 8 and 10, is stouter than *r*, and extend from the dorsal (under) side of the mentum (*M*) up to the anterior of the pharyngeal processes. The pair *s* is termed by Sharp the hypopharyngeal sclerites, and would seem largely to support the oral tissue, and in a great measure keep the mouth cavity open when necessity demands.

The mouth parts thus far described do not differ very materially from those of the bumblebee as given by Sharp (Camb. Nat. Hist. Ins., II, 14; 1901).

Maxillæ. (Pl. XXIII, figs. 7, 9 and 10.) The maxillæ closely appress the labium on either side. They are of rather complicated structure, in that they are composed of a number of separate sclerites. As with the same structure in the honeybee (*Apis*), the distal part in *Tachytes* is considerably shortened, though, if anything, more complex in the wasp.

Lorum. The lorum, which is conspicuous enough in *Apis* and *Bombus* (among others), could not be made out with certainty here. It is possible that each lorum is represented in *Tachytes* by that broad upper inner portion of the cardines which is here thin and less heavily chitinized than the lower part, though it is in no wise separated therefrom. (See pl. XXIII, fig. 9, *N* and *C*.)

Stipe. (Pl. XXIII, figs. 7, 9 and 10, *St*.) Articulated to the distal end of each cardo is the stipe, which comprises the largest portion of the maxillæ. Figure 9 represents an inner view of one of the maxillæ; it will be observed that the stipe is heavily chitinized and composed of several pieces. Near the tip of each stipe arises the large six-jointed maxillary palpus.

Galea. (Pl. XXIII, figs. 7, 9 and 10, *MX*.) The large blade-like galea of the honeybee is here represented by a short, stout lobe articulated to the stipe. It is armed with stout as well as with fine hairs.

Lacinia. (Pl. XXIII, fig. 9, *L*.) Arising from a spur of chitin on the inner side of the galea, near its distal extremity, is a well-formed, curved lobe, which would seem to represent the lacinia. When in position, each of these lobes is seen to overlie the more basal of the two dorsal pairs of chitinized lobes or scales of the labium. (See pl. XXIII, fig. 8, *k*.) MacGillivray (Ann. Ent. Soc. Am., V, No. 3, 231-8; 1912) describes and illustrates the lacinia in several groups of Hymenoptera, where, as in *Tachytes*, it consists of a thin pilose lobe far smaller than the galea. The inferior, distal edge of the stipe and the basal portion of the galea are thin and flap-like (fig. 9).

Labium. (Pl. XXIII, figs. 7, 8 and 10.) Commencing from its base, the labium is composed of the submentum (*SMt*); mentum (*M*); and the ligula, which comprises the fused glossæ (*GL*), the paraglossæ (*PGL*), and several small sclerites. The submentum is a small, delicate, V-shaped sclerite lying in

the membrane between the stipes, cardines and mentum. It does not appear to be articulated to or otherwise connected with the large mentum, but lies immediately behind it. The mentum is the large, heavily chitinized piece forming the body of the labium. Just before and on each side of its wedge-shaped extremity are the four-jointed labial palpi (*LP*). On either side, at about the middle of its length, the mentum sends an extension dorsad, which is secured in a degree to the inner lateral edge of the stipe of the maxillæ.

Glossa. Anterior to and arising from the mentum is the largely membranous ligula, consisting of the fused glossæ and the free paraglossæ. It is tongue-like at its tip (labellum). At the base of the ligula is the translucent ventral supporting plate of the ligula, which is grooved to the extremity of the ligula (fig. 7, *gl, gr*). The dorsal extremity of the latter (fig. 8, *GL*) is beset with rather appressed, apically expanded hairs arranged in transverse rows.

Hypopharynx. The glossæ are sometimes termed the hypopharynx, but Snodgrass (Anat. of the Honeybee, U. S. D. A. tech. ser. No. 18, pp. 49-50; 1910) has shown that the honeybee does not possess a hypopharynx. To quote this author: "The duct of the salivary glands of insects in general opens upon the base of the labium in front of the hypopharynx. In the honeybee the salivary opening is on the dorsal side of the base of the ligula, between the paraglossæ. . . . . This alone would show that the glossa is not the hypopharynx of the bee, as many authors have supposed, for otherwise the opening of the salivary duct should be ventrad to the base of the glossa. In fact, this makes it clear that the bee does not possess a hypopharynx. There is, however, a conspicuous chitinous plate located on the anterior part of the floor of the pharynx, having two terminal points hanging downwards over the lower lip of the oral aperture; but, although this plate is truly hypopharyngeal in position, it is not the homologue of the organ called the hypopharynx in other insects."

This statement appears to apply as well to *Tachytes,* which has the opening of the salivary glands similarly situated between the scales of the paraglossæ (pl. XXIII, fig. 8, near *h*). The portion above and beyond the mentum, being largely membranous, bears several strengthening sclerites of small size (pl. XXIII, fig. 8, *g, h, e*); *g,* the most anterior of these, lies

at the dorsal base of the glossæ and is somewhat V-shaped in cross section, sending out a ventral arm (*f*) to either side to connect the piece with the thin paired plates (*e*, figs. 7 and 8). These are situated at the base of the mentum and are also connected with the two lateral pieces (*d*). There is, in addition, a more or less central arched piece, through the curve of which the tube of the salivary glands passes.

Paraglossæ. (Pl. XXIII, figs. 7 and 8, *PGL.*) These arise from the two partly free dorsal chitinized lobes (*i*), and extend ventrad on either side as thin transparent processes (fig. 8, *PGL*). The curved sclerite (*h*) lies in the inner membrane of the piece *i*, and is secured to *g* near the base of its posterior arm (*f*).

Mandibles. (Pl. XXIII, fig. 7, *MD*, base; pl. XXV, figs. 21 and 22.) These are large and stout, bidentate within, and with a distinct emargination exteriorly (on the lower side) before the middle. In the male the mandibles are more slender than in the female.

How Food is Taken.

It may be well to mention, in the first place, that this process was not observed; the writer having given the mouth parts considerable study, believes that his views are correct. To see how food is taken up by the mouth parts and conveyed to the œsophagus, constant reference must be made to figures 8 and 11. The former figure we have just considered; the latter is a somewhat diagrammatic dorsal view, chiefly of the labium. As before stated, the epipharynx hangs down as a lobe from the labrum, while ventrad of (opposite) the former is the floor of the pharynx. It is between these two, therefore, that the passage (*o*) to the esophagus extends. The anterior end of the pharynx (*p*, fig. 11) is free; that is, extends forward as a horizontal, let us say, lobe, below and behind which is a thin-floored blind sac or pouch (*t*, fig. 8). Between the paired lobes *i* and *k* is a longitudinal channel or groove (fig. 11), which terminates posteriorly just before the aforesaid lobe (*p*). The ligula at this point slopes down rather abruptly (*x*, fig. 11); this is just about ventrad of *p*, figures 8 and 11, the slope ending in the form of an emargination or arc (*c*), with its center or inclined floor (as viewed from above) directed anteriorly. The anterior edge of the pharyngeal lobe (both figures) can be made to fit this emargination or curve

very nicely (for here the membrane, falling off steeply, allows the lobe *p* to rest flush or coincide with *c*, figure 11), and when serving such a purpose shuts off the passage (*b*) to the blind sac below. By comparing the two figures with one another and following the arrows in figure 11, commencing with the apical arrow (*A*), which is seen departing from the ventral groove of the ligula (as seen in figure 7, *gr*), and keeping in mind that the dotted portions of the arrows are below or behind the transverse lines which they intersect, it can be seen how nectar or other liquids may by a ventral-to-dorsal route be drawn, presumably by capillarity, into the mouth opening (*o*). If the insect raises the pharyngeal lobe, the lower passage *b* (fig. 11) leading to *t* (fig. 8) is opened; the latter is frequently found filled with pollen, which is probably taken at or near the pouch, and does not follow the same initial course as the liquids.

The glossa, of course, can be lengthened or shortened by the insect by blood pressure and the action of muscles, this action playing an important part when the wasp is taking food.

Thorax.

(Pl. XXII, fig. 1, lateral view; fig. 3, dorsal; fig. 4, ventral.)

The compact form as well as the hardness of the thorax does not permit its three divisions to be as readily determined as one would desire, while the fusion of the first abdominal segment (*IT*) with the thorax has led many systematists into the error (or convenience?) of considering the former a part of the metathorax. The latter is here the smallest division of the thorax.

Prothorax (*1*). This is of moderate size, but comparatively larger than in the honeybee, and somewhat drawn in under the scutum of the metathorax. Its notal (dorsal) portion has a transverse anterior notch, while a second notch behind the first divides the prothorax into the proscutum and proscutellum. The proscutum forms a complete ring, which narrows ventrad, while the proscutellum terminates apparently at the shoulder tubercles (*L*). The latter are also known as the *prothoracic lobes* or *posterior lobes* of the pronotum. They protect the first thoracic spiracles, and are of some importance in the classification of the Hymenoptera into the larger divisions or series. Fernald (Chlorioninæ of N. A. and West Indies, Proc. U. S. N. M., XXXI, p. 300; 1906) terms the anterior

dorsal and lateral division of the prothorax the *neck*, and the more elevated posterior portion the *collar*. The pleural or side sclerites (propleuron) are represented by the large episternum (*Eps*), which is partly covered by the overlapping pronotum.

Mesothorax (*2*). This is the largest of the three thoracic divisions. Dorsally it is composed of the convex scutum (*Sct*), and the succeeding shorter piece, the scutellum (*Scl*). These combined constitute the mesonotum. From the anterior borders of the scutum, posteriorly, run the parapsidal furrows. The scale-like tegulæ (*tg*) which cover the base of the fore wings are situated under the lateral edge of the scutum. The pleural portion of the mesothorax consists of the large anterior episternum (*Eps*) and the more posterior epimeron (*Epm*). The episterna do not meet on the mid-ventral line, as do the epimera, for their whole length (fig. 4, *Epm*); there is therefore no suture in this case separating the pleural from the sternal portions. The mesosternum proper (*S*; fig. 4) is situated caudal of the epimera and between the middle coxæ.

Metathorax (*3*). This is very small. Dorsally it consists of the wing-bearing notum (*N*), behind which is the yet smaller postnotum. The side of this segment (*pl*) is evidently not divided into the two usual pieces by suture, such as exists in the mesothorax. The small, grooved metasternum lies immediately behind the larger metasternum.

Appendages of the Thorax. *Wings.* (Pl. XXIV, fig. 14.) The wings are inserted between the notal and pleural elements of the mesothorax and metathorax, respectively, and inasmuch as the fore wings are the chief organs of flight the mesothorax is strongly developed at the expense of the inconspicuous metathorax.

The veins (fig. 14) and the cells (fig. 15, *Tachysphex propinquus*) follow the usual nomenclature, the lettering being from Fernald's Chlorioninæ. The system is comparatively simple, and while it may not be as logical as some others, it is easily remembered and applied, and for that reason used here. An enlarged figure of the inner margin of the primaries (pl. XXV, fig. 33) shows the fold for the reception of the hooks on the costal margin of the secondaries. One of these hooks is illustrated in figure 12. By this device the wings are united to move in unison.

Legs. (Pl. XXII, fig. 5, posterior leg of female; pl. XXVIII, figs. 83 and 85, femur of male.) These are stout and spinose, more so in the female than in the male. The fore legs are used largely for digging. The fore and middle tibiæ each bear but a single apical spur (calcar), while the hind tibiæ have two. These spurs are fringed inwardly with short, stiff hair; those of the anterior pair have the basal portion emarginate inwardly and armed there with a short comb, which, coöperating with a similar one in an emargination at the base of the first tarsal joint, serve as antennal cleaners, the antennæ being drawn between them. This structure is show in figure 88, in the genus *Notogonia.* Figure 89 shows this modification in *Astata,* which is sometimes classified with the Larridæ, but is perhaps more allied to the Nyssonidæ. Notice that the spur is here bifurcate, while it is simple in all the Larridæ which I have examined.

The male of *Tachytes distinctus* has each fore coxa armed inwardly with an elongate process, which bears some bristles apically (pl. XXIII, fig. 13 *H*). while the fore-femora of the same sex are excavate on the under side near the base; these conditions are good examples of secondary sexual characters, and do not occur in all the species of the genus *Tachytes.*

ABDOMEN (fig. 2). *Propodeum* (figs. 1 and 3, *IT*). This portion is also known as the median segment, and erroneously as the metathorax (in part). Inasmuch as it is the first abdominal segment, the author sees no reason for calling it a part of the thorax; therefore, the word propodeum is here used for that part morphologically belonging to the abdomen, however much it may appear to be a portion of the thorax, while what is really the second abdominal segment will in the taxonomic portion of this paper be referred to as the first segment of the abdomen. The abdomen, including the propodeum, has seven visible segments in the female and eight in the male. The second segment, though tapering narrowly to the propodeum, is practically sessile; the next two segments are the widest; the last one in the female has a more or less wedge-shaped disc bounded laterally, except at the base, by a carina, and covered with an even appressed pubescence. This surface is known as the pygidium (fig. 2, *pg,* and 92), and is of considerable taxonomic importance; it is a generic as well as a specific character. Beneath the pygidium is the sheathed sting. The male has a smaller, blunter pygidium, while the eighth ventral segment is well emarginate (fig. 111).

As has been remarked, the species just considered is a typical example of the family. In studying the various Larridæ it will be found that certain groups depart rather widely in a number of anatomical points from the genus *Tachytes*. For example, certain Larridæ have three perfect ocelli, others lack the pygidial area, while the shape of the head and thorax and the neuration of the wings may differ to a considerable degree, to say nothing of size. These various characters are noted in the systematic portion of this paper, in the keys and generic descriptions.

PART II.

Systematic Larridæ.

The following keys will serve to separate the family Larridæ from other aculeate wasps:

Fore wings longitudinally folded in repose.....Series DIPLOPTERA
Fore wings not longitudinally folded in repose.....Series FOSSORES

FOSSORES.

Pronotum and tegulæ in contact; a transverse chink between ventral abdominal segments 1 and 2.....SCOLIIDÆ and MUTILLIDÆ
Pronotum and tegulæ in contact; no transverse chink between ventral abdominal segments 1 and 2.....POMPILIDÆ
Pronotum and tegulæ not in contact.....SPHEGOIDEA (SPEGIDÆ *sens. lat.*)

SPHEGOIDEA.

1. Middle tibiæ with two apical spurs..SPHEGIDÆ, NYSSONIDÆ, STIZIDÆ, MELLINIDÆ
   Middle tibæ with but one apical spur or with none..... 2
2. Abdomen with a strong constriction between first and second segments, the first segment much narrower, therefore, at apex than the second .....PHILANTHIDÆ
   Not having the above characters..... 3
3. Abdomen elongate and clavate, the first segment petioliform; eyes deeply and narrowly emarginate within; fore wings with usually but one well-defined submarginal cell.....TRYPOXYLONIDÆ
   Abdomen not as above; eyes never deeply emarginate within..... 4
4. Only one complete submarginal cell in the primaries; head very robust, subquadrate; metathorax sometimes spinose..CRABRONIDÆ
   At least two complete submarginal cells in the primaries, the second of these cells sometimes petiolate; head normal, rarely very stout; metathorax never spinose..... 5
5. Abdomen petiolate or subpetiolate, the petiole or subpetiole (which is often quite short) distinctly marked off from the remainder of the abdomen, not cylindrical; first discoidal cell of fore rarely if ever longer, usually distinctly shorter, than the marginal cell; marginal cell lanceolate, its apex pointed on the costal margin of the wing; two submarginal cells, the second not petiolate; stigma strong, often very marked; ocelli perfect.....PEMPHREDONIDÆ
   Abdomen tapering to a point at its junction with the thorax; subpetiole, if present, not clearly differentiated from the rest of the abdomen; first discoidal cell of primaries usually distinctly longer than the marginal, which is more often truncate or rounded at apex; two or three submarginal cells, the second sometimes petiolate; ocelli variable..... 6

6. Labrum large, longer than wide, conspicuously exserted; ocelli aborted, represented by cicatrices; mandibles not notched beneath; transverse-median nervure of hind wings sinuate or somewhat S-shaped ..... BEMBECIDÆ

Labrum small, largely or entirely hidden beneath the clypeus; at least the anterior ocellus perfect; mandibles frequently notched beneath; marginal cell of fore wings usually appendiculate at apex; transverse-median nervure of hind wings straight; not S-shaped; fore tibial spur not furcate..... LARRIDÆ

The Larridæ have a world-wide distribution. They are well represented in the temperature zones of both hemispheres. A large number of species have been described from the oriental Region. Some of the neotropical species are conspicuous for their size and coloration.

The limits of the family are not clearly defined, so that the group may be said to be in an unstable condition. Kohl, Sharp and others treat it as a subfamily or group of the Sphegidæ, but Cresson, Ashmead, and Mercet (in Spain) are among those who give these wasps full family rank.

The writer has not examined all of the genera of the North American Larridæ, and has seen but few extra-American species. For this reason he is not prepared to enter at any length into its family characteristics, and consequently bases his conclusions very largely upon North American species and literature. As considered here, the genera *Trypoxylon* and *Pison* (which have deeply emarginate eyes and the abdomen subclavate), *Dienoplus, Astata, Dinetus* and *Diploplectron* (which have the middle tibiæ with two apical spurs), sometimes considered as belonging to the family, are here excluded from the Larridæ.

The type of the genus *Larra* and of the family Larridæ is *Larra anathema* (Rossi), a large, handsome species of the Old World, and not differing greatly from our own *Larra analis.*

The family can be conveniently divided into two groups or subfamilies:

Those having the posterior ocelli imperfect—Larrinæ.

Those having three perfect ocelli; these may be called Atypical Larridæ. The type genus belongs to the Larrinæ.

KEY TO THE GENERA OF KANSAS LARRIDÆ.

1. Three perfect ocelli 2
   The two posterior ocelli more or less distorted 7
2. Second submarginal cell petiolate; mandibles entire or excised beneath; small forms 3
   Second submarginal cell not petiolate; mandibles excised beneath; larger forms ..... *Lyroda*
3. Only two submarginal cells; marginal cell not appendiculate, acute at apex 4
   Three submarginal cells 5
4. Two recurrent nervures ..... *Miscophus*
   Three recurrent nervures ..... *Miscophinus*
5. Mandibles strongly excised beneath; pygidial area of ♀ well defined, broad and shining; clypeus of ♂ with a fringe of hair on either side ..... *Plenoculus*
   Mandibles not or very feebly excised beneath; pygidium of ♀ hardly or not shining 6
6. Hind femora thickest apically; pygidial area well defined, pilose in both sexes; marginal cell lanceolate, not appendiculate. *Bothynostethus*
   Hind femora normal, more or less fusiform; pygidial area poorly defined or lacking; marginal cell usually truncate and appendiculate at apex ..... *Niteliopsis*
7. A transverse swelling or ridge before the superior ocellus, thereby forming an angle with the upper portion of the head and the front; posterior ocelli quite small, sometimes indistinct, proximate and transversely arranged or nearly so; a long facial depression on each side of the frons for the reception of each antenna; fore femora of ♂ not emarginate beneath near the base 8
   A more or less dome-shaped circular swelling behind the anterior ocellus (no transverse swelling before it); posterior ocelli larger, oblique to nearly longitudinal in position; forehead rounded; fore femora of ♂ emarginate near the base, except in some *Tachytes* 9
8. Mandibles distinctly dentate within; pronotum hardly depressed beneath the level of the mesonotum; posterior margin of the pronotum nearly straight (transversely); pygidium of ♀ practically bare ..... *Larra*
   Mandibles more or less distinctly bidentate within; pronotum somewhat depressed beneath the level of the mesonotum; posterior margin of pronotum angled mesad into the mesonotum; pygidium pubescent in both sexes ..... *Notogonia*

9. A more or less distinct swelling or fold along the inner eye margins; posterior ocelli placed obliquely, elongate and curved posteriorly; pygidium of ♀ well defined, its apical portion rather sparsely pubescent; insects never densely pilose .....*Larropsis*

No swelling along the inner eye margins; pygidium of ♂ and ♀ entirely naked to densely clothed with pubescence 10

10. Posterior ocelli very elongate, anteriorly almost longitudinal in position, their posterior end curved into a hook or flat spiral pygidium covered with bristles or pubescence (usually metallic), that of ♀ always well defined; fore tarsal comb of ♂ composed of short spines; insects often bee-like .....*Tachytes*

Posterior ocelli reniform or oblong; pygidium of ♀ usually well defined and naked; fore tarsal comb of ♀ with long flexible spines; insects never densely pubescent nor bee-like, *Tachysphex*

The genus *Miscophinus,* which is inserted in the above key, has not as yet been reported from Kansas, though it is probable that it occurs in the state.

Order of treatment: *Larra, Notogonia, Larropsis, Tachytes, Tachysphex, Lyroda, Plenoculus, Niteliopsis, Miscophus,* and *Bothynostethus.*

LARRA Fab.

Fab.; Ent. Syst. t. II, p. 220; 1793.
Syn. *Larrada* Sm. 1856.

Form rather stout, sparsely pubescent. Head wider than thorax, with a longitudinal fold along the inner eye margin, and somewhat angulate and depressed above; antennæ rather stout, usually in a distinctly elbowed position, each rather long scape fitting into a longitudinal facial impression; anterior ocellus small and round, in a depression which forms an obtuse angle with the rest of the face; posterior ocelli indistinct, oval and transverse, situated on the posterior edge of a transverse fold from eye to eye; mandibles emarginate beneath, in our species indistinctly dentate within. Thorax long; pronotum not angled into the mesonotum, and not or very slightly depressed below the level of the latter; propodeum long, truncate posteriorly; marginal cell of the fore wings truncate and with an evident appendiculation; legs stout and spinose. Abdomen slightly depressed.

♀. Pygidium well defined, shining, naked except for a very few hairs along the marginal furrow; comb of fore tarsi not well defined.

♂. More pilose than the ♀; pygidial area margined; fore femora entire beneath at the base; eighth ventral segment with a shallow emargination.

Larra analis Fab.

(Fig. 16, wings; 24, mandible; 107, pygidium, ♀.)

Larra analis Fab.; Syst. Piez., 1804, p. 220. ♀.
Larra analis Fox; Proc. Acad. Nat. Sci. Phil., 481-482; 1893. ♀.

A large deep black species, with the apical portion of the abdomen bright red. The ♂ of this species is more pilose, has the abdomen entirely black and the pygidial area pilose.

From Cheyenne and Douglas counties. Rare.

NOTOGONIA Costa.

Costa; Ann. Mus. Zoöl. Univ. Napoli (Ann. IV), p. 80 *et* 82; 1867.
Syn. *Larrada* Sm. 1856.
Larra Patt. 1880.

Form rather slender to stout. Head slightly wider than thorax, the facial folds and depressions much as in *Larra;* antennæ comparatively slender, the scape rather long; ocelli bordering on a low swelling, posterior ocelli small, oval, flattened and transverse; mandibles emarginate beneath, with two more or less distinct teeth within. Thorax rather long; pronotum angled into the mesonotum and somewhat depressed below the level of the latter; propodeum long and truncate posteriorly; marginal cell of fore wings truncate, the appendiculation fairly distinct; legs elongate, spinose. Pygidial area pilose.

♀. Comb of fore tarsi hardly differentiated, with only a few spines; pygidial area with well-defined sides, rounded triangular, and pubescent except at extreme base.

♂. Fore femora entire beneath at base; pygidial area not well defined, finely though not densely pubescent throughout; eighth ventral segment rounded.

This genus is close to *Larra,* and, like it, is poorly represented in the United States.

Notogonia argentata (Bve.).

(Fig. 34, ocellar area; 49, thorax; 88, antennal cleaner; 80, fore tarsus; 97, pygidium, ♀.)

Larra argentata (Bve.); Ins. Afr. at Amer., p. 119, taf. III, f. 9; 1805.
Notogonia argentata Fox; Proc. Acad. Nat. Sci. Phil., 485-486; 1883. ♂ ♀.

An easily recognized steel gray species, with subhyaline wings and long legs. Barton, Russell, Phillips and Douglas counties; June-September. More common in eastern Kansas.

LARROPSIS Patt.

Patton; Ent. News, III, 90; 1892.
Syn. *Ancistromma* Fox; Proc. Acad. Nat. Sci. Phil., 487; 1893.

Form moderately stout, naked or sparsely pubescent. Head usually short, regularly rounded, distinctly wider than thorax; antennæ usually longer than in either *Tachytes* or *Tachysphex,* the scape being comparatively shorter and stouter than in the above genera; head in front distinctly raised along the inner eye margin; ocelli bordering a swelling which is less distinct and more weakly furrowed than in *Tachytes* or *Tachysphex;* fore ocellus round, the posterior pair flattened, elongate and hooked posteriorly, shorter and more obliquely arranged than in *Tachytes;* mandibles emarginate beneath, with two teeth interiorly. Thorax

moderate; propodeum somewhat truncate posteriorly; marginal cell more or less truncate, with an appendiculation. Pygidial area at least partly pilose.

♀. Comb of fore tarsi of stout thorns, perhaps a little longer than in *Tachytes;* pygidial area with the borders well defined, covered with sparse pubescence for its apical half or two-thirds.

♂. Fore femora emarginate near the base beneath, the inner border of this emargination forming a distinct tooth, more acute than in the other genera having this emargination; pygidial area without raised borders, sparsely pubescent; eighth ventral segment of the abdomen rounded out, in a few species very shallowly emarginate.

This genus is represented in our state by twelve species. These insects are seldom seen. They are sometimes taken about the burrows of animals.

KEY TO THE SPECIES OF LARROPSIS.

Females.

1. Interocular space at vertex less than or about equal to the length of antennal joints 2 and 3 united, and about equal to one-third the interocular space at the base of the clypeus..... 2
   Interocular space at vertex distinctly wider than the length of antennal joints 2 and 3, and two-thirds to three-fourths the interocular space at the base of the clypeus..... 3
2. Disc of propodeum with delicate striæ which diverge from beyond the base; wings nearly clear.....*distincta*
   Disc of propodeum granulate or with very indistinctly diverging striæ; wings smoky .....*aurantia*
3. Antennæ long and setaceous, longer than head and thorax (except in *divisa,* where they are about equal to head and thorax); fourth antennal joint three to four times as long as its middle diameter 4
   Antennæ shorter and stouter, shorter than head and thorax; fourth antennal joint about two times as long as its middle diameter.. 6
4. Pygidium well polished, sparsely large punctate, almost naked; form slender; abdomen black and red; wings light smoky....*conferta*
   Pygidium rough, rather densely punctate, pubescent; form stouter, with dark, fuscous wings 5
5. Antennæ longer than head and thorax; second abdominal segment reddish; tarsi black or nearly so.....*rugosa*
   Antennæ about as long as head and thorax; abdomen varying from red and black to red; tarsi testaceous.....*divisa*
6. Wings smoky; insect black; ocellar space very closely punctate .....*vegetoides*
   Wings pale yellowish hyaline; most of the thorax, and the abdomen entirely, pale brownish red; ocellar space rather sparsely punctate .....*chilopsidis*

Males.

1. Interocular space at vertex not wider than length of antennal joints 2 and 3; wings clear 2
   Interocular space at vertex decidedly wider than the length of antennal joints 2 and 3; wings clear to fuscous 3
2. Disc of propodeum with delicate striæ, which diverge from beyond the base; third antennal joint one-third shorter than 4..*distincta*
   Disc of propodeum finely granulate; antennal joints 3 and 4 subequal ..... *aurentia*
3. Wings clear or nearly so 4
   Wings fuscous 8
4. Abdomen entirely, legs and venation largely, dull yellowish brown; length, 8 mm. ..... *tachysphecoides*
   Abdomen not entirely red or yellowish brown; venation dark brown or black 5
5. Second submarginal cell almost triangular, the first transverse cubitus therefore very close to the second on the radius; first recurrent almost interstitial with the first transverse cubitus; a rather distinct sulcation from the anterior ocellus forward; abdomen black ..... *pænerugosa*
   Venation normal, not as above; sulcation from anterior ocellus indistinct or wanting 6
6. Abdomen red and black, rarely entirely red ..... *conferta*
   Abdomen black; punctation a little coarser than in *conferta* 7
7. Disc of propodeum with a longitudinal sulcus only on apical half, and with some rather indistinct raised lines diverging from the base to the sides nearly to its middle length; punctation of scutum rather coarse and so close as to give it an opaque appearance; length, 6 mm. ..... *minor*
   Disc of propodeum with a longitudinal sulcus usually extending its entire length, the diverging lines wanting or very short; punctation of scutum rather fine, the punctures well separated; scutum, therefore, rather shining and smooth; length, 8-11 mm.. *bruneri*
8. Antennæ distinctly shorter than head and thorax together; basal abdominal segments red ..... *divisa*
   Antennæ as long as head and thorax, or nearly so; at most the second segment red 9
9. Entirely black; scutum closely but distinctly punctured, therefore shining; abdomen also shining and with indistinct apical fasciæ on segments ..... *ater*
   Second abdominal segment red; scutum so closely punctured as to give it a granulate opaque aspect; no sericeous fasciæ on abdomen ..... *rugosa*

Larropsis distincta (Smith).

Larra pennsylvanica (?) Bve.
Larrada distincta Smith; Brit. Mus. Cat. Hym., IV, 292. ♀.
Larra distincta Patton; Proc. Bost. Soc. Nat. Hist., XX, 390; 1880. ♂ ♀.
Ancistroma distincta Fox; Proc. Acad. Nat. Sci. Phil., 491-2; 1893. ♂ ♀.

♀. Rather stout; anterior margin of clypeus narrowly emarginate mesad, bidentate laterally, though not strongly; antennæ somewhat shorter than head and thorax, not stout, joint 3 shorter than 4; vertex with fine, close punctures, which are more separate on scutum; disc of propodeum with diverging striæ, posterior face with transverse striæ and a strong sulcus; tarsal comb not strong; longer spur of hind tibiæ nearly as long as the first joint of the hind tarsi. Abdomen finely punctate; pygidium long and narrow, deep punctate, rather blunt apically. *Black;* tarsi dull brownish, wings nearly clear, venation brown, abdomen with the apical margins of segments 1 and 2 particularly with indications of red. Scarcely pubescent; pygidial bristles brownish. Length, 11-13 mm.

♂. Anterior margin of clypeus emarginate mesad, indistinctly bidentate laterally; sculpture about as in ♀. Abdomen black or red and black. More pubescent than in ♀. Length, 8-12 mm.

Three ♂ ♂ from Norton county; Aug. 24 to Sept. 4, 1912. The ♀ ♀ are eastern examples.

Larropsis aurantia (Fox).

(Fig. 36, ocellar area.)

Larra aurantia Fox; Ent. News, II, 194; 1891. ♀.
Ancistromma aurantia Fox; Proc. Acad. Nat. Sci. Phil., 490; 1893. ♂ ♀.

♀. Stout. Anterior margin of clypeus subtruncate, a little notched mesad, the lateral angle drawn out into a large pointed tooth, a small tooth just inside the same; antennæ long, slender and acuminate, joints 3 and 4 subequal; front, vertex and scutum very finely and closely punctate, a little more separately on scutellum; disc of propodeum rugose-granulate, sometimes with indications of diverging striæ, a median impressed line; posterior face coarsely transverse-striate, with a median furrow; legs rather strongly spinose; abdomen shining; pygidium rather sparsely punctate. *Black;* tarsi largely dull reddish brown; wings fuscous, venation blackish; abdomen orange. Short sparse pubescence on tibiæ and tarsi; pile on pygidium pale yellowish brown. Length, 11-15 mm.

♂. Anterior margin of clypeus more narrowly rounded out, emarginate mesad, a stout tooth laterally; the clypeus sparsely coarse-punctate; punctation of head somewhat coarser than in ♀, that of scutum about as in that sex; legs rather feebly spinose; wings clearer than in ♀, subhyaline; apical abdominal segments black; head, thorax and abdomen with silvery pile, which is rather sparse except on face; pygidial pubescence yellowish brown. Length 10-11 mm.

Four ♀ ♀ and 1 ♂; Norton, Phillips, Thomas and Lane counties; July 3 to Aug. 24, 1910-'12.

Larropsis conferta (Fox).

Ancistromma conferta Fox; Proc. Acad. Nat. Sci. Phil., 494-5; 1893. ♂ ♀.

♀. Rather slender. Anterior margin of clypeus broadly rounded out, indistinctly dentate laterally; joint 3 of antennæ one-third to one-fourth shorter than 4, the interocular space at vertex very little less than antennal joints 3 and 4; head and scutum finely and distinctly punctate; disc of propodeum with a median furrow (widened apically) and rather fine transverse striæ; posterior face finely granulate-striate, with a median sulcus; legs slender, moderately spinose; pygidial area shining, sparsely punctate and hairy. *Black;* tibiæ and tarsi more or less brownish, wings fusco-hyaline, yellowish in age, venation dark; basal abdominal segments and usually apex of pygidium reddish. Insect with sparse sericeous pile. Length, 10-15 mm.

♂. Antennæ stouter and sculpture coarser than in ♀; colored as in that sex, but slightly more pilose. Length, 8-11 mm.

Seven ♀ ♀ and two ♂ ♂; western Kansas.

Larropsis bruneri (Smith).

(Fig. 101, eighth ventral plate of ♂.)

Ancistromma bruneri Smith, H. S.; Ent. News, XVI, 249; 1906. ♂.

♂. In form like *conferta.* Anterior margin of clypeus strongly rounded out; front and vertex not quite as closely punctate as in *conferta;* joint 3 of antennæ a little shorter than 4, the interocular space almost equal to joints 2-4; thorax with fine separate punctures; disc of propodeum rather coarsely granulate-striate mesad (elsewhere simply granulate) where it is depressed, and often distinctly carinate, sides granulate, posterior face granulate-striate, and with a deep dorsally widened sulcus; wings almost clear. *Black;* apex of tarsi reddish. Sparsely pilose and fasciate. Length, 7-11 mm.

A fair series from the western part of the state. They were compared with a paratype from Nebraska.

Larropsis pænerugosa (Vier.).

(Fig. 46, tip of fore wing.)

Ancistromma pænerugosa Viereck; Trans. Am. Ent. Soc., XXXII, 210; 1906. ♂.

♂. Very like *bruneri,* from which it may be distinguished by the somewhat broader interocular space at vertex, the more distinct median impression before the ocellar space, and by the fact that the first and second transverse-cubitus veins are very proximate on the radius, and the first transverse-cubitus and first recurrent veins are nearly or quite interstitial. *Black;* wings clear; colored and ornamented as in *bruneri.* Length, 8 mm. (type).

One ♂, University of Kansas. Collected in Clark county, Kansas; June; F. H. Snow.

Larropsis minor n. sp.

♂. Somewhat slender. Anterior margin of clypeus rounded out, not dentate laterally, strongly and closely punctate; antennæ rather stout, almost as long as head and thorax; joint 3 somewhat shorter than 4, the interocular space at vertex about equal to joints 2-4; front and vertex very closely punctate, the punctures not very fine, however; scutum and scutellum rather coarsely and very closely punctate, giving these regions a granulate aspect; pleuræ about as dorsum; disc of propodeum granulate, with an apical sulcus; indications of transverse striæ and basal striæ, which diverge to about the middle length, sides and posterior face granulate, the latter with a large fovea near the top; legs weakly spinose; venation normal; abdomen finely punctate; pygidial area with large, separate punctures; eighth ventral segment rounded. *Black;* fore femora at base, tibiæ slightly, and tarsi in part, ferruginous; venation dark brown. Face in part, pleuræ and sternum in part, and the abdomen with pale pile; the abdomen rather indistinctly pale sericeous-fasciate. Length, 6 mm. (type).

One ♂, Seward county, Kansas, August 18, 1911.

Related to *bruneri* and *pænerugosa*, from which it differs in being much smaller, in having generally coarser and closer punctures, etc.

Larropsis divisa (Patton).

(Fig. 99, pygidium ♀.)

Larra divisa Patton; Bull. U. S. Geol. Surv., V, 368; 1879. ♀.
Ancistromma divisa Fox; Proc. Acad. Nat. Sci. Phil., 495; 1893. ♂ ♀.

♀. Stout. Anterior margin of clypeus broadly rounded out, bidentate laterally; antennæ long and slender, joint 3 a little longer than 4; front rather coarsely but closely punctate; scutum compactly punctate; disc of propodeum sulcate mesad and there rather coarsely transverse-striate, posterior face granulate-striate and with a median impressed line; legs tolerably spinose; pygidial area of the usual form, well punctate. *Black;* tarsi in part brownish red, wings dark fuscous, venation brown to dark brown; first segment of abdomen largely black, the rest orange red or the abdomen all red. Pubescence of pygidium light yellowish brown. Length, 14-16 mm.

♂. Anterior margin of clypeus not dentate laterally; antennæ shorter than in ♀, distinctly shorter than head and thorax; sculpture generally coarser; metathorax transversely rugose. First three abdominal segments red. Sparse silvery pile. Length, 12-13 mm.

Eleven ♀ ♀; from Wallace, Stanton, Seward, Stevens and Morton counties; July 30 to August 18, 1910-'11.

Larropsis ater n. sp.

(Fig. 100, ventral plate of ♂.)

♂. Medium stout. Anterior margin of clypeus rounded out, not dentate laterally, strongly punctate, much more sparsely and coarsely so distally; antennæ rather stout, nearly as long as head and thorax together, joint 3 somewhat shorter than 4, the interocular space at vertex about equal to joints 2-4; front and vertex finely punctate, in

fact almost granulate, punctures sparser on anterior part of vertex and in the vicinity of the anterior ocellus; scutum and scutellum closely punctate, the punctures not very fine but distinct; pleuræ closely punctate; disc of propodeum with some irregular median transverse striæ and a shallow median depression which is stronger and widened apically; the rest of the disc is granulate, sides of propodeum finely granulate, the posterior face granulate-striate, a narrow median sulcus near the top of the posterior face and a raised line near the bottom (pedicel of abdomen); legs moderately spinose; venation normal; abdomen finely punctate, the pygidium coarsely so, eighth ventral segment rounded out. *Black;* apex of tarsi somewhat testaceous, as also a part of tegulæ; wings dark fuscous, venation still darker. Sparse erect brownish pile on upper portion of frons and on the vertex and sides of propodeum; abdomen with weak dorso-lateral silvery fasciæ of pile; pygidium sparsely pubescent. Length, 11.5 mm. (type); range, 8.5-11.5 mm.

Twenty-three specimens from Meade, Morton, Wallace, Norton, Grant, Stanton and Seward counties. There are also specimens from Montana, etc., in the Philadelphia Academy of Sciences.

This insect has been regarded by Fox as a black variety of *rugosa,* from which it differs constantly in a large series of both species. *Ater* has the scutum shining and less punctate, as opposed to the almost opaque and granulate scutum of *rugosa.* It also averages smaller than *rugosa* and the antennæ appear a little stouter; the median impressed line of the disc of the propodeum is not polished apically, as is somewhat the case with *rugosa,* while the abdomen is weakly fasciate in the new species. It is related to *rugosa* and *tenuicornis.*

Larropsis rugosa (Fox).

Ancistromma rugosa Fox; Proc. Acad. Nat. Sci. Phil., 496-7; 1893. ♂.

♀. Moderately slender. Anterior margin of clypeus broadly rounded out, with two rather obtuse lateral teeth; mandibles slender, bidentate within; antennæ long and slender, the apical joints particularly, joints 3 and 4 subequal; front and vertex finely and closely punctuate, appearing almost granulate; pronotum and mesonotum punctate about like head; disc of propodeum finely granulate, but with rather irregular transverse striæ on the shining, rather broad and slightly depressed median line which widens apically; the narrow sulcus on the posterior face widens dorsally; the face itself is finely granulate; legs rather delicately spinose; the tarsal comb of weak, slender spines; longer metatibial spur shorter than first joint of hind tarsi; abdomen finely and closely punctate; pygidium rather narrow, its sides very slightly bowed out, rather broadly rounded apically and somewhat closely punctate and armed with short bristles for its apical two-thirds or more. *Black;* mandibles dark red in the middle; tip of tegulæ brownish; tarsi somewhat brownish; wings dark fuscous iridescent; second abdominal segment orange red; pygidial bristles brownish. Practically devoid of pubescence or pile. Length, 16 mm.

♂. Anterior margin of clypeus more narrowly rounded in this sex, not dentate; antennæ stouter; sculpture somewhat coarser; the disc of the propodeum more distinctly furrowed; pygidium less pilose. Colored like the ♀.

One ♀, Norton county; eleven ♂ ♂, Wallace, Morton and Wichita counties; August 5-24. There is also a ♀ (this sex I do not find described) in the collection of the Philadelphia Academy of Sciences. The species is easily recognized by the orange-red band on the abdomen and by the opaque notum.

Larropsis vegetoides (Vier.)

Ancistromma vegetoides Viereck; Trans. Am. Ent. Soc., XXXII, 208; 1906. ♀.

♀. Very like *vegeta*. Of moderate build. Clypeus rounded out anteriorly, sparsely coarse punctate, two obscure lateral teeth; antennæ not long, of fairly uniform thickness, joints 3 and 4 subequal; interocular space at vertex about equal to antennal joints 2-4; front and vertex very finely punctate; scutum and scutellum appearing granulate, the sides finely granulate-punctate; disc of propodeum rather indistinctly and finely transverse-striate; a median sulcus, which is quite deep; posterior face finely granulate-striate, the median sulcus deep; legs well spined, the fossorial comb well developed; abdomen hardly punctate above, a few large punctures below; pygidium smooth, with some large separate punctures, its sides somewhat arcuate. *Black;* tarsi becoming brown apically; wings rather dark fuscous; apex of pygidium brownish. Insect covered with very short, inconspicuous pile; pygidium with sparse bristles on apical half. Length, 12 mm.

Two ♀ ♀, Clark county, Kansas; June; F. H. Snow. One of these specimens is the type.

Larropsis tachysphecoides (Vier.)

Ancistromma tachysphecoides Viereck; Trans. Am. Ent. Soc., XXXII, 209-10; 1906. ♂.

"Belongs near *chiloxsidis*, from which it is very different."—Vier.

♂. Somewhat slender. Anterior margin of clypeus rounded out, no teeth laterally; antennæ not slender, of rather uniform thickness, third joint about one-quarter shorter than fourth; interocular space at vertex only a little less than at clypeus and greater than length of antennal joints 2-4; punctures well separated on the middle of front and vertex, more closely punctate laterally; scutum and scutellum with rather large separate punctures, the mesopleuræ with large shallow ones; disc of propodeum transversely striate at the median furrow posterior face granulate, with a wide and deep fovea near the top, the sides rather finely rugose-striate; legs moderately spinose; third submarginal cell of fore wings wider than the second along the radius; last dorsal segment of abodmen with shallow punctures, the eighth ventral slightly emarginate mesad. *Black;* tegulæ and venation testaceous; legs, except coxæ, trochanters, and a part of the middle femora, and the abdomen brownish testaceous. Very slightly pubescent. Length, 8 mm. (type).

Clark county, Kansas; F. H. Snow. There is also a ♂ in the U. S. N. Museum from Mesilla Park (New Mex.).

This may eventually prove to be the ♂ of *chilopsidis*, which, besides having the same habitat, it resembles a good deal.

Larropsis chilopsidis (Ckll. & Fox).

Ancistromma chilopsidis Ckll. & Fox; P. Ac. Philad., 137; 1897. ♀.
Ancistromma zerbeii Viereck; Trans. Am. Ent. Soc., XXXII, 208-9; 1906. ♀.

♀. Anterior margin of clypeus rounded out, slightly and narrowly emarginate mesad, obtusely bidentate laterally, with large sparse punctures; front and vertex with well-separated and moderately small punctures; antennæ not long, of nearly uniform thickness, joint 3 very slightly longer than 4; interocular space at vertex more than the length of antennal joints 2-4; prothorax and mesothorax very finely and closely punctate, nearly granular; mesopleuræ closely punctate; disc of propodeum with very fine striæ, which are transverse in the middle and more or less diverging at the base and apex; the propodeum hardly sulcate except at base and apex, the posterior face with a sulcation, this face and the sides indistinctly fine striate; legs strongly spinose, the fossorial comb of quite long bristles; abdomen shining, a few punctations ventrad; pygidial area polished, rather broad, the sides bowed out, quite sparsely punctate and pilose at apex. "*Testaceo-castaneus;* head black excepting the greater part of the clypeus, mandibles and antennæ, which are castaneous" (Vier., for *zerbeii*); antennæ darker apically; sternum of thorax largely black, also a portion of the base of coxæ; wings yellowish hyaline, venation yellowish. Pronotum and mesonotum with considerable short, pale, brownish pile; pygidium with a few pale reddish-brown hairs at apex. Length, 10-12 mm.

Five ♀ ♀, Clark county, Kansas; F. H. Snow. One of the above specimens has the thorax nearly all black and the apical half of the antennæ nearly black.

While at the Philadelphia Academy of Sciences last winter, the writer noticed the resemblance of *zerbeii* Vier. to *chilopsidis* Ckll. & Fox. Not having the first species with me to compare, notes were taken on the type *chilopsidis*. These were found to fit *zerbeii* well, and a specimen of the latter sent to Mr. Fox, at Philadelphia, to compare with *chilopsidis* proved in his opinion to be the same as *chilopsidis*. The insect is allied to *vegetoides*, notwithstanding the difference in color, etc., between the two.

TACHYTES Panzer.

Panzer; Krit. Rev., II, p. 129; 1806.
Syn. *Lyrops* Illig.; 1807.

Form stout to rather elongate, more or less pubescent, sometimes beelike. Head as wide as to slightly wider than thorax; antennæ usually rather stout; ocelli bordering on a swelling which is more or less furrowed longitudinally, the posterior pair very elongate, flattened and hooked posteriorly, their anterior portion almost longitudinal in position; mandibles emarginate beneath, with one or two teeth within; propodeum

rounded posteriorly; marginal cell obtuse at apex, the appendiculation rather indistinct; legs stout, spinose; abdomen often depressed; pygidial area always with appressed pile or bristles, which are usually metallic in color.

♂. Comb of fore tarsi composed of stout thorns; pygidial area well defined by carinate borders.

♀. Fore femora simple or emarginate beneath; fore coxæ with or without an elongate process; pygidium with or without carinate borders; its pubescence, in all the species which I have seen, is silvery; eighth ventral segment emarginate.

This genus, which Fox divides into two sections, is well represented in our state. These are perhaps the most commonly seen of our larrids.

Key to the Species of Tachytes.

Females.

1. Anterior margin of clypeus produced in the middle into a rather *narrow* lobe (figs. 52 and 56); lateral margins of clypeus distinctly dentate; legs (femora and tibiæ) largely ferruginous.. 2
   Anterior margin of clypeus not produced into a lobe, though most frequently rounded out, sometimes slightly emarginate mesad and usually dentate laterally; legs (except in the large, yellowish-winged species *distinctus*) black..... 3
2. Pygidium scarce constricted preapically, covered with fine golden pile ..... *validus*
   Pygidium somewhat constricted before apex (fig. 90), its bristles bronzy .....*mandibularis*
3. Clypeus armed with a large prong on either side (fig. 61); pygidium triangular (fig. 93), with rather sparse, stout, appressed bristles, which are pale golden or silvery.....*mergus*
   Clypeus without a lateral prong; pygidium well covered with pile or fine bristles (figs. 91 and 92)..... 4
4. Clypeus rounded out, armed laterally with more or less distinct teeth; abdomen black or black and ferruginous..... 5
   Clypeus without teeth (fig. 54), its anterior margin subtruncate, with a slight production mesad; abdomen black with brassy or silvery fasciæ; wings light fuscous.....*obductus*
5. Metatibiæ with at least the basal half of the outer posterior row of spines short, blunt and thorn-like, the row much stouter than those on the first joint of the hind tarsi, and usually extending to quite near the base of the tibiæ (fig. 82); pygidium (at least in fresh specimens) with some erect hair in addition to the fine appressed pile; species rather small..... 6
   Metatibiæ with the spines not short as in the above, usually well pointed and differing but little from those of the first joint of the hind tarsi, and usually ending (or beginning) at a good distance before the base of the tibiæ; no erect hair on pygidium, the latter golden or bronzy..... 7

6. Mandibles very narrowly notched exteriorly (fig. 25); black species ..... *obscurus*
Mandibles with the notch normal; the first two or three segments of the abdomen ferruginous ..... *abdominalis*

7. Abdomen in part red 8
Abdomen entirely black 9

8. Clypeus not or very slightly emarginate mesad; pygidium not at all constricted near the apex, bronzy; species with considerable erect pile on head and thorax..... *fulviventris*
Clypeus shallowly emarginate mesad (fig. 53); pygidium a little narrowed before apex; erect pubescence rather sparse. *rufofasciatus*

9. Abdomen with four silvery fasciæ; wings hyaline; legs black.....10
Abdomen three-fasciate; wings yellowish, dark apically; legs largely ferruginous; pygidium with fine pubescence... *distinctus*

10. Pygidium silvery; spines on legs yellowish white; abdomen greasy-sericeous ..... *sericatus*
Pygidium bronzy; spines on legs brown; abdomen hardly greasy-sericeous ..... *pepticus*

Males.

1. Fore coxæ simple; fore femora near the base entire..... 2
Fore coxæ with an elongate posterior process (fig. 13, *H*); fore femora beneath near the base emarginate (figs. 83 and 85).... 5

2. Joints 9-11 of antennæ visibly broadened on one side (fig. 42), thereby contrasting with the two apical joints; abdomen partly red or entirely black..... *fulviventris*
Joints 9-11 of antennæ normal, not broadened (figs. 40 and 41).... 3

3. Flagellum with the basal joints distinctly rounded out beneath (fig. 40); thorax with long and rather dense golden pubescence; legs partly ferruginous..... 4
Flagellum with the basal joints not or very slightly rounded out beneath (fig. 41); the long pubescence of thorax not dense; clypeus broadly rounded out (fig. 59); legs black..... *pepticus*

4. Eighth ventral segment rather narrowly emarginate, the lobes broad and rounded..... *validus*
Eighth ventral segment rather broadly emarginate, the lobes usually narrow and more pointed (fig. 108)..... *mandibularis*

5. Pygidium with pile largely suberect; small black species..... 6
Pygidium with pile all appressed; usually larger species..... 7

6. Silvery fasciæ of abdomen distinct; body well covered with pile; thorax scarcely shining, with larger, coarser punctures.. *obscurus*
Silvery fasciæ of abdomen not very well defined; insect sparsely pilose; thorax shining, the punctures there finer and more separate ..... *intermedius*

7. Wings yellow, their apical portion dark, abdomen black; larger species ..... *distinctus*
Wings pale yellowish hyaline, not dark apically; abdominal segments 1 and 2 usually fulvous; rather small species. *rufofasciatus*

T. sericatus is not represented in the collection by a male. This sex resembles *obscurus* a good deal, but the sericeous pubescence is more abundant in *sericatus*.

Tachytes validus Cress.

Tachytes validus Cresson; Trans. Am. Ent. Soc., IV; 1872. ♂ ♀.
Tachytes validus Fox; Trans. Am. Ent. Soc., XIX, 237; 1892. ♂ ♀.

♀. Stout and broad. Clypeus with a quadrate median production, three small lateral teeth; third joint of antennæ longer than fourth; vertex with rather strong separate punctations; scutum very finely punctate; scutellum scarcely impressed; disc of propodeum with a slight impressed line, a subcircular subapical fovea, and a strong median sulcus on posterior face; hind tibiæ with moderately stout spines; abdomen rather broad, depressed; pygidium convex, depressed along the sides of its apical portion. *Black;* legs, except coxæ, trochanters and most of femora, yellow-ferruginous (sometimes this color is more widespread); wings pale yellowish-hyaline, venation ferruginous; pygidium with fine silvery pile. Pubescence of head and thorax pale golden; abdomen with four silvery fasciæ. Length, 18-22 mm.

♂. More slender as a rule than ♀. Joints 1-5 of flagellum strongly rounded out beneath; scutellum with a distinct median impressed line; eighth ventral plate rather narrowly emarginate. Length, 15-19 mm.

One ♀, labeled "Kans.," identified by E. T. Cresson, December, 1878. The abdomen is lacking in this specimen.

Tachytes mandibularis Patt.

(Fig. 40, antenna; 52, clypeus; 90, pygidium, ♀; 108, eighth ventral segment, ♀.)

Tachytes mandibularis Patton; Proc. Bost. Soc. Nat. Hist., XX, 394; 1880. ♂ ♀.
Tachytes mandibularis Fox; Trans. Am. Ent. Soc., XIX, 237-238; 1892. ♂ ♀.

♀. Stout. Clypeus with the median process narrower than in *validus*, three distinct lateral teeth; third joint of antennæ somewhat longer than fourth; vertex finely and closely punctate; scutum likewise; scutellum scarcely impressed; disc of propodeum with a wide median sulcus or furrow, a subtriangular fovea before apex, posterior face with a strong median furrow; spines on posterior tibiæ rather slender; abdomen broad, somewhat depressed; pygidium subpyriform, somewhat narrowed before apex, the short bristles not concealing the disc. *Black;* basal half of mandibles, scape beneath, apex of femora, tibiæ and tarsi, ferruginous; wings pale yellowish hyaline, venation pale brown; pygidial area with bronzy bristles. Pubescence dense, rather dull golden; abdomen with four silvery fasciæ. Length, 14-17 mm.

♂. Anterior margin of clypeus drawn out mesad, a large distinct lateral tooth; joints 1-5 of antennæ rounded out beneath; hind tarsi not spinose; eighth ventral segment rather broadly emarginate. Length, 12-14 mm.

Douglas, Pratt, Kiowa, Russell, Rawlins, Osborne and Rooks counties; June-August.

A rather uncommon species in our state. The western Kansas examples are rather large, and agree in some respects with *propinquus* Roh.

Tachytes obductus Fox.

(Fig. 54, clypeus, ♀ ; 91, pygidium, ♀ .)

Tachytes obductus Fox; Trans. Am. Ent. Soc., XIX, 250; 1892. ♀ .

♀ . Moderately stout. Anterior margin of clypeus produced into a moderately broad subtruncation, which itself is slightly produced mesad; frons and vertex rather finely and closely punctate; joints 3 and 4 of antennæ subequal; scutum punctate about like vertex; scutellum not impressed; disc of propodeum very finely granulate-reticulate, the sides more shining and very finely punctate, the median impressed line broad and indistinct, obscurely transversely striate and terminating in a strong, rather pyriform subapical fovea, posterior face with an impressed line; legs not very spinose, metatibial spines moderately stout, fore tarsal comb short; pygidium with the sides nearly straight (much as in *obscurus*). *Black;* spines of legs brown to black, wings light fuscous; pygidium with fine bright golden pile. Pubescence yellowish white or pale yellow; abdomen with segments 1-5 brassy fasciate or with silvery fasciæ. Length, 10.5 mm.

Four ♀ ♀ ; Osborne county, Kansas, August 3, 1912. It appears to be a rather rare insect. The ♂ does not seem to have been described.

Tachytes abdominalis (Say).

(Fig. 55, clypeus, ♀ ; 82, metatibia.)

Larra abdominalis Say; West. Quar. Rep., II, 77; 1823. ♀ .
Tachytes abdominalis Fox; Trans. Am. Ent. Soc., XIX, 248-9; 1892. ♀ .

♀ . Rather elongate. Clypeus rounded out, very slightly and narrowly emarginate mesad, two lateral teeth; third antennal joint not longer than fourth; vertex with fine, close punctations; scutum with more separate punctations; scutellum not impresed; disc of propodeum with or without a slight impressed line, the subapical fovea rather shallow, posterior face with a rather narrow sulcus; metatibial spines stout, the more basal one blunt and thorn-like; the two recurrent veins usually quite proximate on the cubitus; abdomen rather long, pygidium rather broadly rounded apically, its pile dense and diverging. *Black;* apex of tarsi more or less reddish; wings subhyaline; abdominal segments 1 and 2 or 1 to 3 ferruginous; pygidium as a rule silvery golden basally, becoming bronzy to darker apically. Pubescence of head, thorax and legs pale golden to nearly silvery; abdomen with four pale golden fasciæ. Length, 9-13 mm.

A good series from western Kansas. The ♂ has not as yet been found or recognized.

Tachytes intermedius (Vier.)

Tachysphex intermedius Viereck; Trans. Am. Ent. Soc., XXXII, 211-12; 1906. ♂.

♂. Slender. Clypeus well produced and rounded, not dentate laterally; third joint of antennæ a little shorter than fourth; vertex with fine separate punctations, as also scutum, which is shining; scutellum not impressed; disc of propodeum finely granulate, without an impressed line, apical fovea shallow and rather indistinct, a strong sulcus on posterior face; abdomen smooth and slender, eighth ventral segment rather broadly emarginate. *Black;* marked like *obscurus;* wings hyaline, venation testaceous. Pubescence sparser than in *obscurus;* that of head, thorax and abdomen white or silvery; suberect pile on pygidium; that of legs with a golden tint. Length, 8.25 mm. (type).

One ♂; Douglas county, Kansas; F. H. Snow.

This is not a *Tachysphex,* as first described, and is therefore not related to *Tachysphex punctifrons* or *æthiops,* as stated by its describer, but is close to *obscurus;* the clypeus is more produced than in that species, however, the punctation more delicate, the thorax and abdomen more polished, and the pubescence sparser.

Tachytes obscurus Cress.

(Fig. 25, mandible, ♀; 58 clypeus, ♂.)

Tachytes obscurus Fox; Trans. Am. Ent. Soc., XIX, 249; 1892. ♂ ♀.
Tachytes texanus Cresson; Trans. Am. Ent. Soc., IV, 217; 1872. ♂.
Tachytes obscurus Fox; Trans. Am. Ent., XIX, 249; 1892. ♂ ♀.

♀. Rather slender. Clypeus rounded out, two blunt lateral teeth; joints 3 and 4 of antennæ subequal; mandibles broad with a very narrow exterior notch; vertex and scutum with fine separate punctations; scutellum not impressed; disc of propodeum very finely granulate, and with sparse shallow punctures, subapical fovea distinct, as is also the sulcus on the posterior face; metatibial spines quite stout and thorn-like, stouter than the same in *abdominalis;* abdomen rather long, somewhat depressed, pygidium nearly straight, much like that of *abdominalis,* covered with fine appressed pile and sparse erect hair. *Black;* wings subhyaline; pygidium with the pile somewhat silvery at base, bronzy apically. Pubescence of head and thorax silvery; abdomen with four silvery fasciæ. Length, 13-14 mm.

♂. Mandibles normally notched; spines on posterior tibiæ not stout as in ♀; eighth ventral segment of abdomen broadly emarginate. Length, 9-11 mm.

Four ♀ ♀ and numerous ♂ ♂ from western Kansas, besides a few from Douglas county, in the eastern part of the state. I have found the ♀ to be very rare.

Tachytes rufofasciatus Cress.

(Fig. 53, clypeus, ♀.)

Tachytes, rufo-fasciata Cresson; Trans. Am. Ent. Soc., IV, 217-18; 1872. ♂.

Tachytes rufofasciatus Fox; Trans. Am. Ent. Soc., XIX, 247-8; 1892. ♂ ♀.

♀. Rather slender to moderately stout. Clypeus rounded out anteriorly, a little emarginate mesad and bidentate laterally; joint 3 of antennæ longer than 4 (subequal in some slender specimens); vertex and thorax finely and closely punctate; scutellum not impressed; disc of propodeum with shallow, indistinct punctures, subapical fovea rather shallow, the sulcus on the posterior face deep; spines on posterior tibiæ not stout; abdomen sometimes rather long; pygidium a little constricted before the apex, the pile fine and dense. *Black;* wings nearly clear; apical portion of legs more or less reddish, spines pale; abdomen varying from entirely to scarcely at all ferruginous, the ferruginous commencing from the base as in *fulviventris;* pygidium bright golden. Pubescence of head and thorax whitish or nearly so, the erect hair sparce; abdominal fasciæ golden. Length, 11-15 mm.

♂. Clypeus rather narrowly produced; eighth ventral segment broadly emarginate; apex of trochanters, all the tibiæ and tarsi ferruginous; apex of segments 1 and 2 of abdomen ferruginous or testaceous. Length, 11-15 mm.

The identification of these few Kansas specimens is somewhat doubtful. One, a ♀, is quite small, and here the clypeus is not emarginate as in the larger specimens. This small one is from Morton county; the others, which are stouter as well as larger, were taken in the northern part of the state. The ♂ ♂ hail from Texas.

Tachytes fulviventris Cress.

(Fig. 53A, clypeus. ♂; 42, antenna, ♂.)

Tachytes fulviventris Cresson; Proc. Ent. Soc. Phil., IV, 466; 1865: ♀.
Tachytes cælebs Patton; Bull. U. S. Geol. Surv., V, 355. ♂.
Tachytes fulviventris Fox; Trans. Am. Ent. Soc., XIX, 243; 1892. ♀ ♂.

♀. Stout, a little less so than *pepticus.* Clypeus broadly produced anteriorly, the two lateral teeth obscure or prominent; third joint of antennæ longer than fourth; vertex finely punctate, scutum likewise; scutellum not impressed; disc of propodeum without an impressed line, subapical furrow shallow but distinct and transversely striate, a strong sulcus on posterior face; spines on posterior tibiæ moderately stout; abdomen hardly broadened; pygidium convex, the sides nearly straight, covered with fine pile. *Black;* mandibles slightly reddish mesad, last four tarsal joints reddish; wings hyaline, venation pale brown; segments 1-3 of abdomen reddish, pygidial area with black and bronzy pile. Appressed pile pale golden to whitish, the rather dense, erect pubescence pale griseous; abdomen with three silvery fasciæ. Length, 12-17 mm.

♂. Clypeus broadly produced anteriorly and rounded much as in *pepticus;* joints of antennæ 9-11 widened on one side; abdomen red and black or entirely black. Length, 11-14 mm.

Rather common in western Kansas. In the black variety (♂) the antennal joints 9-11 are not always distinctly widened, sometimes making it hard to separate from *pepticus.*

Tachytes pepticus (Say).

(Fig. 59, clypeus, ♂ ♀; 109, eighth ventral plate, ♂.)

Lyrops peptica Say; Bost. Jour. Nat. Hist., I, 371; 1837. ♂ ♀.
Tachyets pepticus Fox; Trans. Am. Ent. Soc., XIX, 242; 1892. ♂ ♀.

♀. Stout. Clypeus broadly produced, slightly emarginate mesad, two lateral teeth; mandibles short and stout; third joint of antennæ longer than fourth; vertex finely and closely punctate, scutum likewise, and depressed anteriorly; scutellum very slightly impressed; disc of propodeum with or without a very faint line, a shallow subapical furrow, a strong median sulcus on posterior face; spines on posterior tibiæ rather blunt; abdomen short, rather broad; pygidium rather narrow, its sides nearly straight. *Black;* tarsi largely ferruginous; wings very slightly fuscous or yellowish, venation brownish. Pubescence of face, collar, between the divisions of the thorax, and legs, silvery; scutum and scutellum with very sparse, dark, erect pubescence, pale on propodeum; abdomen with four silvery fasciæ; pygidium with fine bronzy bristles. Length, 13-16 mm.

♂. Anterior margin of clypeus broadly produced and rounded; joints 3 and 4 of antennæ narrowed basally; subapical fovea of propodeum shining and more distinct than in ♀; emargination of eighth ventral segment broad. Length, 9-11 mm.

Numerous specimens from western Kansas. The ♀ ♀ are decidedly black and rather naked.

Tachytes sericatus Cress.

(Fig. 60, clypeus, ♀.)

Tachytes sericatus Cress; Trans. Am. Ent. Soc., IV, 216; 1872. ♂ ♀.
Tachytes sericatus Fox; Trans. Am. Ent. Soc., XIX, 247; 1892. ♂ ♀.

♀. Rather stout. Anterior margin of clypeus rounded out, a little emarginate mesad, bindentate laterally; antennæ rather short, joints 3 and 4 nearly equal; punctation of head and thorax fine; disc of propodeum with a very indistinct median line, the apical fovea not large; pygidium somewhat triangular, not constricted apically, the sides very little bowed out. *Black;* apical joints of tarsi brownish; wings clear; pygidial pile silvery. Head and thorax with long suberect whitish pubescence; legs with silvery pile and medium stout whitish spines; abdomen four-fasciate, the fine appressed silvery hair giving it a rather greasy appearance. Length, 12-14 mm.

♂. "Form more slender than ♀"; joint 3 of antennæ shorter than 4; eighth ventral segment roundly emarginate. Less silvery than ♀. Length, 10-11 mm.

One ♀ ; Hamilton county, Kansas; F. H. Snow.

Fox, in his monograph of the genus *Tachytes*, states that the ♀ has a bronzy pygidium, while Cresson in his description of the species states, "apical segment dull silvery." The Kansas specimen agrees with the latter statement.

Tachytes distinctus Sm.

(Pl. XXII and XXIII, external anatomy; fig. 14, wings; 41, antenna ♂ ; 57, clypeus; 79, 83, 85, legs; 92 and 94, pygidium, ♂ ♀ ; 111, eighth ventral segment, ♂ .)

Tachytes distinctus F. Smith; Cat. Hym. Brit. Mus., IV, 307; 1856. ♀ .
Tachytes distinctus Fox; Trans. Am. Ent. Soc., XIX, 246; 1892. ♀ .
Tachytes elongatus Fox; Trans. Am. Ent. Soc., XIX, 246; 1892. ♂ .

♀ . Stout but rather elongate. Clypeus broadly produced, sometimes slightly emarginate mesad, two obtuse lateral teeth; third joint of antennæ longer than fourth; vertex very finely punctate; scutum punctate about like vertex; scutellum not impressed; disc of propodeum with or without a very faint impressed line, a distinct pyriform subapical fovea, a very strong median sulcus on posterior face; metatibial spines stout, not blunt; abdomen long and depressed; pygidium convex, subtriangular, very slightly constricted before apex, its pile short, fine and dense. *Black;* basal portion of mandibles, scape beneath at apex, tegulæ, legs except sometimes basal portion of femora, ferruginous; wings yellowish hyaline, apically darker, venation light brown; pygidial area with long bronzy and blackish pile. Pubescence of head, thorax and legs pale golden; collar sometimes silvery; abdomen with three silvery fasciæ. Length, 15-22 mm.

♂ . More slender as a rule than ♀ . Anterior margin of clypeus broadly produced; eighth ventral segment of abdomen broadly emarginate; femora largely black; pubescence more griseous than ♀ ; abdomen four-fasciate. Length, 11-17 mm.

A common and easily determined species; the largest of our larrids. Taken throughout the western half of the state; June-September.

Tachytes mergus Fox.

(Fig. 26, mandible; 61, clypeus, ♀ ; 93, pygidium, ♀ .)

Tachytes mergus Fox; Trans. Am. Ent. Soc., XIX, 250; 1892. ♀ .

♀ . Somewhat slender. Anterior margin of clypeus with a distinct lateral prong; mandibles decidedly slender; antennæ likewise, the third joint longer than the fourth; vertex and scutum finely punctate; disc of propodeum with a distinct impressed line and a subpyriform subapical fovea, sulcus on posterior face strong; pygidium triangular, with sparse stout bristles. *Black*; at least the apical joints of tarsi reddish; wings clear. Pubescence silvery; bristles of pygidium silvery; to pale golden. Length: 9 mm.

Two ♀ ♀ , from Osborne county, Kansas, August, 1912. A very distinct and apparently rare species.

TACHYSPHEX Kohl.

Kohl; Berl. Ent. Zeitschrift, XXVII, 166, 1883.
Fox; Proc. Acad. Nat. Sci. Phil., 504-5; 1893.
Syn. *Larrada* Sm.
Larra Patton.

Form slender to stout, pubescence short and usually sparse. Head usually distinctly wider than the thorax, face bituberculate behind the antennæ, the latter moderate, usually more slender in the ♀ than in *Tachytes*; ocelli bordering on a longitudinally furrowed swelling, the anterior ocellus round, the posterior pair more or less reniform, flattened and quite obliquely placed; mandibles more strongly emarginate than in *Tachytes;* thorax rather short; propodeum rounded posteriorly; marginal cell of fore wings more or less distinctly truncate; legs rather slender, spinose.

♀. Comb of fore tarsi of long, flexible spines; pygidial area naked and shining, usually with delicate carinate borders.

♂. Fore femora emarginate beneath at base; pygidial area not well defined, with sparse pile; eighth ventral segment well emarginate; sometimes with a median tooth.

This genus is represented in Kansas by twenty-two species. From a systematic standpoint, it is the most difficult group of the family, as many of the species resemble one another very closely. By paying strict attention to the clypeus, pygidium, venation, antennæ and sculpture, the tables should prove helpful.

The length of the pygidial area in the O ♀ seems to have been overestimated by some writers. The author compares the basal width with the length, which is taken to extend from where the lateral carinæ end (toward and not at the base of the segment) to the narrowed tip of the disc. His figures here given will be found to differ, therefore, materially from those of Fox in his monograph of the Larridæ.

KEY TO THE SPECIES OF TACHYSPHEX.

(Use a compound microscope here.)

Females.

1. Interocular space at vertex always distinctly more than one-half the interocular space at the lower edge of the eyes; face with long pile; vertex with long, erect pile, which is at least as long as the diameter of an antennal joint; vertex and thorax always with well-separated punctures, polished. Immediately behind each posterior ocellus is a convexity which resembles a second ocellus, then follows the transverse postocellar impression...

Interocular space at vertex never distinctly as much as one-half the same space at the lower edge of the eyes; vertex glabrous or with very short pile; vertex and thorax often with very fine and close punctures, often subopaque. Immediately behind each posterior ocellus the slope is scarce or not interrupted to the transverse postocellar impression..... 4

2. Sides of propodeum not striate, or at most with striations only along either edge; dorsum of abdomen, all red.....*clarconis*
Sides of propodeum distinctly striate for the entire length; only the tip of the abdomen red..... 3

3. Antennæ with longer joints, joint 3 nearly three times the length of its diameter, and about as long as joint 4 (fig. 32, *b*); anterior margin of clypeus with a low blunt tooth or lobe..*fusus*
Antennæ with shorter joints, joint 3 about two times as long as its diameter and distinctly shorter than joint 4 (fig. 32, *a*); anterior margin of clypeus without a median lobe or else very slightly produced mesad.....*terminatus*

4. Anterior margin of clypeus with a prominent *median* tooth (fig. 67); pygidium broad and nearly flat, impunctate or nearly, the bounding carina low, tip broadly rounded (fig. 106)..*dentatus*
Anterior margin of clypeus without a *median* tooth; pygidium usually narrow and more or less punctate..... 5

5. Abdomen red or red and black..... 6
Abdomen black 16

6. At least the tibiæ and tarsi reddish, femora more or less red; punctation of thorax very fine and close..... 7
Tibiæ and femora always black, tarsi more or less so; punctation of thorax fine or coarse..... 8

7. Clypeus rounded out for nearly its entire width, a little elevated on its anterior edge mesad, where it is shallowly emarginate, no lateral teeth (fig. 73); clypeus, sometimes thorax in part, femora and abdomen ferruginous; interocular space at vertex a little wider than the length of antennal joints 2 and 3. *propinquus*
Clypeus distinctly notched mesad on its anterior edge, the two lateral teeth distinct (fig. 66); femora largely, and the apex of abdomen, ferruginous; interocular space at vertex about as wide as the length of antennal joints 2 and 3.....*belfragei*

8. Anterior margin of clypeus with a distinct median emargination or incision, and two lateral teeth (fig. 68); upper portion of frons with rather shallow punctures and a finely reticulate surface; pygidium not at all twice as long as wide..*crenuloides*
Anterior margin of clypeus without an emargination or with only a small, shallow one, and with at most one lateral tooth, or without teeth; pygidium longer, from almost two to two and one-half times as long as its basal width..... 9

9. Sides of propodeum distinctly though not always deeply striate, or striate and punctate combined, shining; scutum frequently with close but separate punctures.....10
Sides of propodeum finely granular, subopaque; scutum very finely and closely punctate, thereby sometimes appearing granulate..15

10. Disc of propodeum granulate, and in addition has irregular though strong more or less longitudinal striæ extending from one end of the disc to the other; clypeus with one lateral tooth; upper portion of frons with separate punctures, finely reticulate between punctures; abdomen all red.....*sculptiloides*
    Disc of propodeum coarsely wrinkled; abdomen with only first and second segments red.....*quebecensis*
    Disc of propodeum not as above; wholly or in part red.....11
11. Clypeus entire; medium-sized to rather large species.....12
    Clypeus with one lateral tooth (fig. 72); small species, about 6 mm. long.....13
12. Abdomen entirely red; the second submarginal cell usually distinctly broader than the third along the radius; truncation of marginal cell only a little oblique and a little less than one-half as long as the distance from the third submarginal (along the radius) to truncation (fig. 47); clypeus not produced mesad; length, 7.5-10 mm.....*texanus*
    Abdomen black apically; second and third submarginal cells usually subequal along the radius; truncation of marginal cell decidedly oblique, and always more than one-half as long as the distance from the third submarginal cell to truncation; anterior margin of clypeus a little produced mesad; length, 7 mm. .....*consimilis*?
13. Abdomen black apically; slender species.....*nigrocaudatus*
    Abdomen entirely red.....14
14. Form stout; as viewed laterally the abdomen is not or scarcely longer than thorax and propodeum.....*crassiformis*
    Form slender; abdomen tapering gradually caudad, distinctly longer than thorax and propodeum.....*plenoculiformis*
15. Abdomen entirely red (clear or obscure); clypeus with one lateral tooth (fig. 62), and sometimes with a shallow emargination mesad; length, 8-11 mm.....*tarsatus*
    Abdomen black apically; clypeus entire; scutum finely granular-punctate, subopaque; length, 7.75 mm.....*consimiloides*
16. Wings subfuscous, venation heavy, marginal cell broadly truncate, the third submarginal cell along the radius as broad as the length from the third submarginal cell to truncation (fig. 48); frons very finely granulate, ocellar region (as viewed through a hand lens) opaque; clypeus entire or with an indistinct tooth laterally .....*acuta*
    Wings clear or nearly so, venation not heavy, third submarginal cell along the radius seldom as broad as the length from the third submarginal to truncation; ocellar region shining.....17
17. Clypeus broadly though not strongly rounded anteriorly, entire. *sepulcralis*
    Clypeus subtruncate anteriorly, produced a little mesad, two lateral teeth (including the rather drawn-out edge of clypeus). *glabrior*

—

Males.

1. Interocular space at vertex about two-thirds or more the interocular space at the lower edge of the eyes; upper portion of frons and vertex with rather long, sparse, erect pile, which is about as long as the diameter of an antennal joint, head rather sparsely punctate and polished, pseudo-ocelli present (as in ♀ ♀); abdomen red-tipped, rarely entirely black..... 2
   Interocular space at vertex one-half or less (seldom a little more than) the same space at the lower edge of the eyes; no long, erect pile on vertex; no pseudo-ocelli behind the posterior ocelli 3
2. Front with rather fine, close punctures.....*terminatus*
   Front with larger separate punctures.....*fusus*
3. Abdomen red, or red and black..... 4
   Species entirely black 12
4. Sides of propodeum distinctly striate throughout, often punctate between striæ 5
   Sides of propodeum not striate, or striate only at edges, coriaceous, finely granulate or reticulate..... 9
5. Anterior margin of clypeus slightly emarginate mesad; disc of propodeum coarsely and irregularly wrinkled; length, 9 mm. *quebecensis*
   Anterior margin of clypeus not emarginate mesad; disc of propodeum not as above..... 6
6. Apex of femora, tibiæ and tarsi entirely, reddish yellow...*minimus*
   At most the tarsi are partly reddish or reddish brown..... 7
7. Small, slender species; length, about 6 mm.; apical half of abdomen black .....*nigrocaudatus*
   Larger, stouter species; abdomen all red..... 8
8. Third antennal joint not twice its apical width, antennæ rather stout, a little thickened mesad; thorax and propodeum shining, sparsely pilose .....*texanus*
   Third antennal at least twice its apical width, antennæ hardly thickened mesad; thorax and propodeum with rather abundant pile .....*tarsatus*
9. Abdomen entirely red; clypeus subtruncate (fig. 62); stout species .....*tarsatus.*
   Abdomen dark or black apically; clypeus rounded or subtruncate..10
10. Stout species; length, 6.75 mm.; scutum very finely and closely punctate; longer spur of metatibiæ as long as first joint of hind tarsi; abdomen about equally red and black; an even growth of brassy pile on disc of scutum.....*robustior*
    Slender species; longer spur of metatibæ distinctly shorter than first joint of hind tarsi; abdomen more red than black.....11

11. Scutum with very fine close punctures, appearing granulate; frons granulate-punctate; anterior edge of clypeus rather narrowly rounded, not raised mesad (fig. 71), its apical half sparsely punctate and shining; antennal joints not strongly ciliate; a little brassy pile on middle of scutum.....*dubius*

    Scutum and frons with deep separate punctures; anterior edge of clypeus rounded out for most of its interocular width, a little raised mesad, sometimes slightly emarginate (fig. 70), its apical half very finely reticulate, and in addition there are some large, sparse punctures; antennæ strongly ciliate (fig. 31); scutum with the pile all white.....*propinquus*

12. Width of third submarginal cell along the radius equal to the radius from the third submarginal cell to the truncation (fig. 48); wings subfuscous.....*acuta*

    Width of third submarginal cell along the radius not as much as the length of the radius from the third submarginal cell to the truncation; wings nearly or entirely clear.....13

13. Apex of femora, and tibiæ and tarsi entirely, reddish yellow. *minimus*

    At most tarsi in part reddish brown.....14

14. Scutum strongly depressed anteriorly in the middle; disc of propodeum rather coarsely though uniformly granulate, only striate at base.....*sepulcralis*

    Scutum scarcely or not at all depressed anteriorly in the middle; disc of propodeum coarsely granulate and with irregular (distinct or obscure) longitudinal striæ or raised lines throughout the middle of the disc.....*glabrior*

Tachysphex intermedius Vier. belongs to the genus *Tachytes*, where I have placed it.

Tachysphex propinquus Vier.

(Fig. 15, wings; 31, portion of ♂ antenna; 70 and 73, clypeus; 81, fossorial comb, ♀; 104, pygidium, ♀.)

Tachysphex propinquus Viereck; Ent. News, XV, 87-8; 1904. ♀.

♀. Rather slender. Anterior margin of clypeus rounded out, a little wavy, slightly elevated mesad, where it is a little emarginate, no lateral teeth, rather large sparse-punctate; front finely and very closely punctate; antennæ slender, joint 2 about one-half as long as 3, which is three-fourths or more the length of 4; interocular space just a little more than the length of antennal joints 2 and 3; scutum and scutellum finely and very closely punctate, the former well depressed anteriorly in the middle, sides with shallow contingent punctures; disc of propodeum coriaceous (very finely and evenly granulate), the sides largely coriaceous, posterior face finely striate and with a median almond-shaped fovea; legs slender, the tarsal comb pronounced; venation rather delicate, the marginal cell rather narrowly and obliquely truncate; abdomen very finely reticulate; pygidial area convex, sparse punctate, long and narrow, constricted preapically and just a little more than two times as long as its basal width. *Ferruginous;* head except clypeus, scape at least, and the

thorax more commonly, black (the thorax more rarely all ferruginous). Face and thorax well covered with sericeous pile; abdomen silvery fasciate. Length, 8-12 mm. Related to *posterus* and *ashmeadii*.

♂. Slender. Anterior margin of clypeus broadly rounded out, not or just a little emarginate and elevated apically; no lateral teeth, distally with a few large punctures and finely reticulate in addition, basally very finely and closely punctate; antennæ somewhat thickened in the middle, strongly ciliate along one side joint 2 about two-thirds the length of 3, which is about two-thirds or more the length of 4; interocular space nearly or quite equal to antennal joints 2-4; front finely granulate, less so above and at vertex, postocellar depression moderately deep; scutum and scutellum with rather large, separate punctures; the punctures are a little coarser on the pleuræ; disc of propodeum coriaceous, the sides closely punctate, posterior face rather coarsely striate, with a deep fovea; legs weakly spinose, the larger metatibial spur distinctly shorter than first joint of hind tarsi; marginal cell broadly truncate; abdomen rather narrow, finely and indistinctly punctate, much more strongly punctate on the apical segments, eighth ventral segment broadly emarginate and with a low and indistinct tooth mesad. *Black;* a spot on the scape apically, the margin of the clypeus and the three basal abdominal segments, reddish; tarsi partly brownish. White pile on face and thorax; abdomen silvery fasciate. Length, 7.5-9.5 mm.

Numerous ♀ ♀ and a few ♂ ♂, chiefly from southwestern Kansas; July-August, 1911 and 1912.

Tachysphex dubius Fox.

(Fig. 71, clypeus, ♂.)

Tachysphex dubius Fox; Proc. Acad. Nat. Sci. Phil., 515; 1893. ♂.

♂. Rather slender. Anterior margin of clypeus rather narrowly rounded out (imperfectly subtruncate), the lateral angles rather sharp to obtuse, nearly smooth on its apical one-third, the rest finely punctate; antennæ somewhat thickened and pilose, joint 3 distinctly shorter than 4, the interocular space somewhat less than 3 and 4; front finely granulate; vertex finely and closely punctate; thorax a little depressed anteriorly in the middle, finely and closely punctate; disc of propodeum finely granulate, the sides reticulate-granulate, posterior face granulate and with indications of larger striæ, a transverse carina separates this face from the disc, posterior fovea large and wedge-shaped; legs feebly spinose, larger metatibial spur much shorter than first joint of hind tarsi; marginal cell rather widely obliquely truncate; abdomen fairly long, finely reticulate, eighth ventral segment with a wide emargination and a low median tooth, the sides dentiform. *Black;* first three abdominal segments red; the apical segments largely reddish brown or darker; all the tarsi more or less testaceous apically; wings clear. Well covered with pile, which on the middle of the scutum is very sparse and of a brassy hue; abdomen distinctly fasciate. Length, 7.5-9 mm.

A fair series from north central Kansas presents some variations. The insect seems very close to *consimilis*.

Tachysphex belfragei (Cress.).

(Fig. 66, clypeus, ♀.)

Larrada belfragei Cresson; Trans. Am. Ent. Soc., IV, 215; 1872. ♀.

♀. Medium stout. Anterior margin of clypeus well rounded out, and with a narrow mesal emargination and two lateral teeth; joint 3 of antennæ slightly shorter than 4, the interocular space equal to 2 and 3 or perhaps a little less; front and vertex very finely and closely punctate, scutum likewise; disc of propodeum strongly reticulate, the sides finely and the posterior face coarsely striate, the posterior fovea acute beneath and broad above; marginal cell rounded-truncate; pygidial area moderately well punctate, a little constricted preapically, about two and one-fourth times or less as long as broad at base. *Black;* spot on scape at tip, apex of femora, the tibiæ and tarsi, reddish; venation testaceous; segments 1, 2 and 3 more or less, and the apex of pygidium, reddish. Moderate silvery pubescent. Length, 9-10 mm.

A single ♀; Ellis county; July 19, 1912.

Tachysphex robustior n. sp.

♂. Quite stout. Anterior margin of clypeus rather narrowly subtruncate, the lateral angles sharp; clypeus with large separate punctures; antennæ but little thickened mesad, joint 2 nearly two-thirds of 3, which is shorter than 4; interocular space very little less than joints 3 and 4; front with shallow punctures and very finely reticulate; ocellar space deeply and separately punctate, the vertex finely punctate; postocellar pit not very deep; dorsum of thorax very finely and closely punctate, the sides indistinctly and shallowly so; disc of propodeum very finely granulate, apically broadly subtruncate, sides with fine shallow punctures, posterior face striate, with a rather smooth fovea; legs moderately spinose, longer spur of metatibiæ a little longer than first joint of hind tarsi; wings large, venation delicate, marginal cell narrowly subtruncate, the appendiculation weak, the second and third submarginal cells subequal along the radius; abdomen short and stout, with fine, shallow punctations for the reception of the pile; eighth ventral segment broadly emarginate, no median tooth. *Black;* tarsi reddish brown; venation testaceous; abdominal segments 1 and 2 reddish, the latter obscurely so; the rest of the abdomen is not *deep* black. Frons with dense, silvery pile which extends up to the ocelli; the thorax, legs and abdomen with a good amount of silvery pile (the abdomen being fasciate with silvery); pile of the dorsum of the thorax with a pale brassy-yellow tinge. Length, 5.75 mm.

One ♂; Grant county; July, 1911.

Tachysphex consimilis Cress.

Tachysphex consimilis Fox; Proc. Acad. Nat. Sci. Phil., 526-7, 1893. ♂ ♀

A single ♀ from Norton county is doubtfully referred here.

Tachysphex consimiloides n. sp.

♀. Moderately stout. Anterior margin of clypeus broadly but not strongly rounded out (subtruncate), the lateral angles not very sharp, no teeth, apical half sparsely and irregularly large punctate, the remainder very closely punctate; antennæ slender, joint 2 is one-half of 3, which is

three-fourths of 4; interocular space almost as great as the length of joints 3 and 4; frons quite finely granulate; vertex finely and closely deep-punctate, rather opaque, postocellar depression moderately deep; thorax a little depressed anteriorly mesad, very finely granulate; disc of propodeum even more finely granulate than rest of thorax, nearly coriaceous, the sides about like disc, posterior face more irregularly and coarsely granulate, with traces of striations and a broad, moderately deep, almond-shaped fovea; legs moderate, longer spur of metatibiæ shorter than first joint of hind tarsi; venation moderately heavy, the marginal cell rather narrow and scarcely obliquely truncate; abdomen short; pygidium slightly convex and with large scattered punctures in addition to being finely reticulate, barely twice its basal width. *Black;* wings clear, venation brownish testaceous, first three abdominal segments red. Insect well supplied with sericeous pile; abdomen silvery fasciate. Length of type, 7.75 mm.

There are several paratypes, all of which are in fresh condition, from Barton county, Kansas; June 20, 1912.

This species seems to be most nearly related to *consimilis* and *mundus;* it differs from the former in not having the sides of the propodeum striate, and in having the abdomen silvery fasciate; it can be separated from *mundus* by the entire clypeal margin, etc. The sculpture is even finer than in the larger *tarsatus*.

Tachysphex tarsatus (Say).

(Fig. 36, ocellar area; 62, clypeus, ♂ ♀; 87, fore femur, ♂.)

Larra tarsata Say; Western Quar. Report, II, 78; 1823. ♀.
Tachysphex tarsatus Fox; Proc. Acad. Nat. Phil., 512; 1893. ♂ ♀.

♀. Stout. Anterior margin of clypeus subtruncate, often slightly emarginate mesad, unidentate laterally, the rim wide; joint 2 of antennæ only a little more than one-half the length of 3, which is a little shorter than 4; interocular space about equal to joints 2 and 3, perhaps a little greater; head quite finely granulate, the thorax decidedly so; disc of propodeum coriaceous, sides likewise, posterior face finely striate, the fovea deep; legs moderately spinose; wings nearly clear, marginal cell obliquely subtruncate; pygidium about twice as long as its basal width, and sparsely punctate. *Black;* tarsi largely obscure reddish, venation dark brown; abdomen entirely red. Sparse appressed silvery pile. Length, 8-11 mm.

♂. Clypeus subtruncate, not dentate; interocular space about equal to joints 3 and 4; front coarsely granulate. Colored as in ♀. Length, 7-10 mm.

Common in the western part of the state. Rather easily recognized by its very fine sculpture, size, unidentate clypeus, etc.

Tachysphex texanus (Cress.)

(Fig. 47, tip of wing.)

Larrada texana Cresson; Trans. Am. Ent. Soc., IV, 214; 1872. ♂ ♀.
Tachysphex texanus Fox; Proc. Acad. Nat. Sci. Phil., 513-14; 1893. ♂ ♀.

♀. Stout, nearly as large as *tarsatus*, which it resembles superficially. Anterior margin of clypeus subtruncate, without teeth, the lateral angles sharp, rim rather wide; clypeus quite convex and with a few large punctures on its anterior half; joint 2 of antennæ about one-half of 3, which is a little shorter than 4; the interocular space about equal to joints 2 and 3, perhaps a little greater; frons finely and quite closely punctate basally, the punctures larger higher up; vertex shining, with rather large and deep separate punctures; disc of propodeum rather coarsely granulate, the sides striate, the posterior face more coarsely so, its fovea large and shining, wedge-shaped; legs moderately spinose; venation rather delicate, marginal cell obliquely subtruncate, the second submarginal cell usually a good deal wider than the third along the radius; abdomen finely reticulate; pygidium about two times as long as the basal width, well margined, a little constricted preapically, the whole finely reticulate and with sparse, irregularly disposed punctures. *Black;* legs brownish red apically; wings clear; abdomen all red. Moderately pilose. Length, 7.5-10 mm.

♂. Stout. Clypeus subtruncate, a little produced mesad; punctures coarser in this sex; interocular space a little more than the length of antennal joints 3 and 4; eighth ventral segment of abdomen broadly emarginate, and with no median tooth. Colored as in ♀. Length, 6.5-7 mm.

A good series of ♀ ♀ from western Kansas; two ♂ ♂ from Stevens and Norton counties seem to belong here.

Tachysphex sculptiloides n. sp.

♀. Stout, somewhat like a small *texanus*. Anterior margin of clypeus subtruncate, not emarginate mesad, a distinct lateral tooth; clypeal rim broad and with large punctures at its base, apical half (with the exception just mentioned) smooth and shining; antennæ moderately slender, joint 2 one-half as long as 3, which is a little shorter than 4; interocular space nearly as wide as is the length of antennal joints 2 and 3; frons with moderately fine, shallow and well separated punctures, the interspace finely reticulate; vertex shining, with medium-sized, deep punctures; ocellar depression deep; dorsum of thorax shining, with large, rather close punctures; disc of propodeum rather coarsely granulate, and with irregular, more or less longitudinal and parallel, well separated lines (not so evident in the two cotypes), giving the disc an imperfectly striate effect; sides rather coarsely and strongly striate; a carina separates the disc from the posterior face, which is coarsely striate and with a large, deep wedge-shaped fovea; legs moderately spinose; marginal cell rather narrowly and not very obliquely truncate; abdomen shining; pygidium about two and one-fourth times as long as its basal width, scarce constricted preapically, smooth and very sparsely punctate, the bounding carina fairly prominent. *Black;* wings clear, except that they are slightly fuscous apically; abdominal segments 1-3 largely reddish brown. Pile

rather sparse except on pleuræ; on the head not extending high up on the frons; abdominal fasciæ not very strong. Length (type), 7.25 mm.

Three specimens from Barton county; June, 1912.

Tachysphex nigrocaudatus n. sp.

♀. Moderately slender. Anterior margin of clypeus subtruncate, a low lateral tooth; the clypeus much resembling that of *crassiformis* and *plenoculiformis*, only a little convex, rim rather wide, apical portion of clypeus very little punctate, shining, the basal part rather closely punctate; antennæ rather stout and blunt, joint 2 is about one-half of 3, which is more than three-fourths of 4; interocular space about equal to joints 3 and 4; frons with medium-sized, shallow punctures, which are separated from one another by about their width, these interspaces finely reticulate; vertex shining, with deeper, more separate punctures, ocellar area moderately cleft, the postocellar depression moderately deep; dorsum of thorax shining, hardly depressed anteriorly mesad, with large, deep punctures, their width or less apart; disc of propodeum medium granulate, with short basal striæ, sides rather coarsely but shallowly striate-granulate; an imperfect carina between the disc and posterior face, the latter coarsely striate and with a large wedge-shaped fovea; legs moderately spinose; third submarginal cell along the radius a little longer than the second, and nearly equal to the remainder of the radius to the moderately oblique truncation of the marginal cell; abdomen polished; pygidium well defined, smooth, about two and one-fourth times as long as its basal width, the sides nearly straight, a little constricted preapically, narrowly subtruncate apically, and with a few medium-sized deep punctures towards the sides. *Black;* wings a little dusky; first two and one-half segments of the abdomen red. Insect rather sparsely pilose; abdomen scarcely fasciate. Length (type), 6.5 mm.

Rush county, Kansas; June, 1912. There are two others from Barton and Ness counties; one of these has the pygidium a little more strongly punctate than the type.

♂. Moderately slender. Anterior margin of clypeus truncate, no lateral teeth; antennæ stout, rather blunt apically, pilose, joint 2 more than one-half the length of 3, which is about three-fourths of 4; interocular space about equal to antennal joints 2-4; sculptured about as in ♀; the wedge-shaped fovea on the posterior face of the propodeum broad and deep; eighth ventral segment broadly emarginate; first two or three abdominal segments reddish. Pile rather abundant; the abdomen thereby well fasciate. Length, 4.5-7 mm.

A good series of this decidedly small larrid from western Kansas.

Tachysphex plenoculiformis n. sp.

♀. Rather slender. Anterior margin of clypeus subtruncate, with one lateral tooth (here greatly resembling *crassiformis*, fig. 72), some confluent punctures at base of the rim, the apical half (with the above exception) smooth, polished and inpunctate, the basal half closely punctate, only moderately convex; frons with very close, shallow punctures, which are separated by less than their width, the whole rather finely reticulate; vertex polished, with rather fine, close, but shallow punctures; ocellar area not very much impressed medially, the postocellar depression

deep; antennæ moderate, clothed with silvery pile, joint 2 about one-half of 3, which is somewhat shorter than 4; interocular a little less than joints 3 and 4; scutum a little depressed anteriorly mesad, and with quite close, moderate-sized punctures; disc of propodeum evenly granulate, the sides rather strongly striate, the posterior face separated from the disc by an imperfect carina, the face shining, rather coarsely and shallowly striate and with a wide, deep, almond-shaped fovea; legs rather slender, only moderately spinose; venation rather weak, marginal cell not very obliquely truncate; abdomen slender, subconic, shining; pygidial area well defined, a little constricted preapically, and with distinct, well-scattered punctures, the pygidium about two times as long as wide at its base. *Black;* apex of mandibles largely reddish brown; abdomen all red. Sericeous white pile sparse except on face; abdomen not well fasciate. Length, 7 mm. (type).

One ♀; Ness county; July 1, 1912. Six paratypes; length, 5.5-7.25 mm.; southwestern Kansas and Norton county, Kansas.

The insect appears to be rather closely related to *wheeleri* Roh., and resembles *crassiformis* Vier. in some particulars. It is more slender than the latter and a little more finely punctate.

Tachysphex crassiformis Vier.

(Fig. 72, clypeus, ♀.)

Tachysphex crassiformis Viereck; Trans. Am. Ent. Soc., XXXII, 210-11; 1906, ♀.

♀. Stout. Anterior margin of clypeus subtruncate, a little produced mesad, with one lateral tooth; antennæ not very slender, joint 3 a little shorter than 4; interocular space a little more than the length of joints 2 and 3 but less than 3 and 4; front finely punctate below, more sparsely so under the fore ocellus; vertex finely and closely punctate; scutum and scutellum polished, with moderately fine separate punctures, especially of the sides, pleuræ finely punctate; disc of propodeum finely and evenly granulate, the sides strongly striate, posterior face distinctly striate, with a deep oval fovea; legs moderately spinose; wing venation not heavy, marginal cell a little obliquely truncate, moderately wide, second submarginal cell just a little wider than the third along the radius; abdomen stout; pygidium fully two times as long as its basal width, the sides a little bowed out and slightly constricted preapically, disc with large sparse punctures. *Black;* scape at apex and distal tarsi reddish; abdomen reddish. Pile moderate; abdominal fasciæ moderate. Length, 7 mm. (type).

Hamilton county, Kansas. Five others, from Stevens, Morton and Stanton counties; July-August, 1911.

Related to *antennatus*, according to Viereck.

Tachysphex crenuloides n. sp.

(Fig. 68, clypeus; 105, pygidium, ♀.)

♀. Robust. Anterior margin of clypeus rounded, rather narrowly but distinctly emarginate mesad, two distinct lateral teeth and a slight indication of a third broader and inner one; a row of coarse, more or less confluent punctures behind the rim of the clypeus, which slopes up from that point, the clypeus shining and almost inpunctate; joint 2 of antennæ

about one-half of 3, which is a little shorter than 4; interocular space just a little greater than antennal joints 2 and 3; frons finely punctate, the vertex more sparsely so behind the ocelli; scutum and scutellum with moderately fine and close separate punctures, these punctures being more separate on the sides; disc of propodeum very finely granulate, the sides finely punctate-striate, posterior face distinctly striate and with a large wedge-shaped fovea with its apex pointing ventrad; legs tolerably spinose; venation normal, the marginal cell narrowly rounded-truncate; abdomen inpunctate above except towards apex, the last ventral plate with confluent punctures on its apical half; pygidium wide, a little less than twice as long as its basal width (the type and cotype have the pygidium only partly extruded), its strong margins strongly bowed out, scarcely constricted preapically, apically moderately broad-truncate, the disc quite sparsely punctate. *Black;* tarsi brownish red; wings clear; abdomen red (this color is neither bright nor clear). Head, thorax, legs and apex of abdominal segments with a good supply of silvery pile. Length, 8 mm. (type).

Morton county; August 5, 1911. Two paratypes, Morton and Grant counties.

Related to *crenulatus*, to which it runs down in Fox's key. The latter species, besides being a good deal the larger, has the frons more finely punctate and less sericeous, the abdomen bright red, and the clypeus more regularly crenulate.

Tachysphex dentatus n. sp.

(Fig. 67, clypeus; 106, pygidium.)

♀. Robust. Anterior margin of clypeus with a long, distinct *median* tooth, and a low, rather distinct one on either side (in addition to the sharp lateral angle), a curved shining fold or ridge behind the median tooth; joint 3 of antennæ just a little shorter than 4; interocular space not greater than antennal joints 2 and 3; front coarsely (thimble-like) granulate; vertex with finer separate punctures; scutum and scutellum so closely punctate as to appear granulate, the sides about as dorsum; disc of propodeum finely granulate, the sides finely striate-punctate, the posterior face strongly striate and with a large wedge-shaped fovea; legs tolerably spinose; wings with the marginal cell rather broadly and obliquely truncate; abdomen with a few punctures on the apical segments; pygidial area nearly flat and almost inpunctate, well margined, the apex broadly rounded, the disc about one and one-third times or a little less than its basal width. *Black;* tarsi more or less reddish brown; wings clear; abdomen all red. Head and thorax with a fair amount of whitish sericeous pile, which is sparse on the abdomen. Length, 9 mm.

A single ♀ from Morton county; August 5, 1911.

A very distinct species.

Tachysphex sepulcralis n. sp.

♀. Moderately stout. Anterior margin of clypeus rather broadly rounded out, no lateral teeth, the lateral angles sharp though not acute, the clypeus coarsely and sparsely punctate apically, closely so basally, rim wide; antennæ moderately slender, joint 2 is one-half of 3, which is

fully three-fourths of 4 and more than twice its apical diameter; interocular space a little more than joints 2 and 3; frons finely and very closely punctate, but less so about the ocelli; vertex with rather large, deep and separate punctures, postocellar depression deep; scutum well depressed anteriorly mesad for at least one-half its length, a little polished and compactly punctate; disc of propodeum granulate, the sides not very distinctly punctate and striate, the posterior face distinctly striate, the sulcus long and narrow; legs moderately spinose; venation not strong, marginal cell moderately truncate, the second submarginal cell distinctly longer than the third along the radius, the distance from the third to the truncation much more than the length of the third along the radius; abdomen shining; pygidium barely two times the length of its basal width, its strongly margined sides nearly straight, very little constricted preapically, very finely reticulate, and with sparse, well-distributed punctures. *Black;* legs a little lighter colored apically; wings a little darkened toward the tip; venation brown. Rather abundant silvery pile, with which the abdomen is well fasciate. Length, 9 mm. (type).

Phillips county, Kansas; Aug. 30, 1912. Three paratypes (one of which is 10 mm. long); Barton and Russell counties.

♂. Anterior margin of clypeus subtruncate, somewhat produced in the middle (more strongly so than in *crassiformis*), the lateral angles sharp; antennæ a little thickened mesad, joint 2 more than one-half of 3, which is a little shorter than 4; interocular space equal to joints 2-4, or nearly; frons with very close, more or less confluent punctures, those of the vertex larger and separated from each other by their diameter or more, vertex when viewed from behind a little depressed; thorax rather coarsely and closely punctate, well depressed mesad for nearly the whole length of the scutum; disc of propodeum somewhat coarsely granulate, and with a few basal striæ, the sides punctate-striate, posterior face coarsely striate, the fovea broad; legs scarcely spinose, wings about as in the ♀, except that the second and third submarginal cells are subequal along the radius; abdomen shining; pygidial area pilose, emargination of eighth ventral segment broad. Colored as in the ♀. Pile moderate, abdomen well silvery fasciate. Length, 7.5 mm.

Barton county, Kansas; June, 1912.

Related to *apicalis*.

Tachysphex glabrior n. sp.

(Fig. 65, clypeus, ♂.)

♀. Moderately stout. Anterior margin of clypeus rather narrowly subtruncate, a little produced mesad (as in *crassiformis*), in addition to the lateral angles there are two distinct lateral teeth; antennæ a little stouter than in *sepulcralis*, joint 2 about one-half of 3, the latter is hardly two times its own diameter at apex and two-thirds to three-fourths the length of 4; interocular space about equal to antennal joints 3 and 4; frons finely punctate; vertex with the punctures more separate, the sculpture being a little finer than in *sepucralis;* disc of propodeum moderately granulate, with poor indications of basal striæ, the sides well striate, the posterior face coarsely so, the almond-shaped fovea large; legs moderately spinose; venation rather weak, marginal cell with the

truncation moderate, width of third submarginal cell along the radius less than the distance therefrom to the truncation; abdomen shining; pygidium much as in *sepulcralis*, barely two times as long as the basal width, polished (finely reticulate in a paratype), punctures large, sparse, but well distributed. *Black;* legs of lighter color apically; wings a little smoky towards the tip; abdominal segments narrowly testaceous apically. Moderately pilose; abdomen well silvery fasciate. Length, 8 mm. (type).

Phillips county, Kansas; August, 1912. Two paratypes, Ellis county.

♂. Anterior margin of clypeus rounded-subtruncate, the lateral angles somewhat dentiform; antennæ long, joint 2 more than one-half the length of 3, which is three-fourths the length of 4; interocular space hardly as much as joints 2-4; frons dull, almost granulate, but finely reticulate in addition; vertex more polished, with fine separate punctures; thorax rather dull, closely punctate; disc of propodeum granulate and with irregular raised lines, the sides more or less striate, posterior face with a few coarse striæ, a strong fovea, and a carina separating that face from the disc; eighth ventral segment broadly but shallowly emarginate. Colored as in the ♀. Length, 5-6 mm.

Rush, Ellis, Osborne and Pratt counties.

Apparently allied to *acuta* Patt. and *similis* Roh.

Tachysphex acuta (Patt.).

(Fig. 48, tip of wing, ♀.)

Larra acuta Patton; Proc. Bost. Soc. Nat. Hist., XX, 390; 1880. ♀.

♀. Stout. Anterior margin of clypeus broadly rounded-subtruncate, laterally not acute, with an indistinct lateral tooth or entire, the apical portion sparsely and large punctate, the basal portion very closely punctate, the rim rather narrow; antennæ slender, joint 3 just a little shorter than 4; interocular space perhaps a little wider than the length of antennal joints 2 and 3; frons finely granulate; vertex very closely punctate, postocellar depression not marked; thorax very closely punctate; disc of propodeum finely reticulate-granulate, the sides granulate and striate, the posterior face more coarsely so, and with a rather broad, shallow fovea; legs moderately spinose; wings broad, venation rather heavy, marginal cell broadly and obliquely truncate, the width of the third submarginal cell along the radius about equal to the length of the radius therefrom to the truncation; abdomen stout, finely reticulate; pygidium about two and one-half times as long as its basal width, smooth and polished and with an irregular row of deep punctures near its strong margins, disc a little constricted preapically. *Black;* wings subfuscous. Pile sparse (the specimens are worn); abdomen more or less fasciate. Length, 7.5 mm.

♂. Anterior margin of clypeus subtruncate, rather broadly produced mesad (here the smooth rim is broadened), the lateral angles sharp; antennæ a little thickened mesad, joint 3 shorter than 4; interocular space hardly equal to joints 2-4; frons granulate; vertex with distinct punctures; thorax rather coarsely close punctate; propodeum with rather indistinct longitudinal striations, the sides not distinctly striate nor granulate, posterior face with a distinct transverse carina

which separates it from the disc, the face coarsely granulate and with large sparse striae and a median fovea; eighth ventral segment broadly emarginate. Colored as in the ♀. Length, 6-6.5 mm.

Five ♂♂ and two ♀♀; Smith, Barton and Russell counties; June-September. The specimens fit Fox's description fairly well and likewise that of Patton, the describer of the species. I have not seen the type. The two ♀♀ are identical with a specimen in the collection of the Philadelphia Academy of Sciences, where, however, there are at least two species in the series labeled *acuta*. It seems to be allied to *nigrescens* ♀, of Rohwer, which, however, has a different clypeus.

Tachysphex terminatus (Smith).

(Fig. 63, clypeus ♀; 32*a*, antenna, ♀.)

Larrada terminata Smith; Cat. Hym. Brit. Mus., IV, 291; 1856.
Tachysphex terminatus Fox; Pr. Ac. Nat. Sci. Phil., 520; 1893. ♂♀.

♀. Greatly resembles *fusus*, from which it differs in not or in scarcely having the clypeus drawn out mesad on its anterior margin; the antennæ are a little stouter, the third joint is decidedly shorter than the fourth; the front is much more closely punctuate, in fact almost granulate; the disc of the propodeum is a little more finely granulate; the pygidium is nearly two and one-fourth times as long as its basal width. Colored as in *fusus*.

♂. Like *fusus*, but the front is more closely punctate, for whereas in *fusus* the punctures just below the anterior ocellus are well separated, sparse, and the face shining there, the same are quite close to almost granular in *terminatus*. The lateral angles of the clypeus are said to be sharp and almost dentiform. Length, 6 mm.

Fairly plentiful in western Kansas, where it has the same habitat as *fusus*.

Tachysphex fusus Fox.

(Fig. 64, clypeus, ♀; 32*b*, antenna, ♀.)

Tachysphex fusus Fox; Proc. Acad. Nat. Sci. Phil., 519-20; 1893. ♂♀.

♀. Moderately stout. Anterior margin of clypeus subtruncate, slightly produced mesad, no lateral teeth; antennal joints 3 and 4 subequal; frons rather coarsely punctate, vertex a little more sparsely so, occiput rather depressed; scutum with strong separate punctures, mesopleuræ likewise; disc of propodeum strongly granulate, the sides finely striate, posterior face more coarsely and rather indistinctly striate, with a median fovea; marginal cell rather narrowly and obliquely truncate; abdomen smooth and shining; pygidium about two times as long as wide at its base, sparsely punctate. *Black;* apex of abdomen red. Silvery pubescence rather dense. Length, 9-11 mm.

♂. Anterior margin of clypeus subtruncate, with sharp lateral angles; frons with large confluent punctures; flagellum a little thickened; thorax with strong separate punctures; propodeum somewhat more coarsely sculptured in this sex. The insect is sometimes entirely black. Length, 6-8 mm.

Fairly common in western Kansas, where it frequents sandy places; one fresh ♀, taken at Lawrence, Douglas county, Kansas, June 12, 1913.

Tachysphex clarconis Vier.

(Fig. 69, clypeus, ♀.)

Tachysphex clarconis Viereck; Trans. Am. Ent. Soc. XXXII, 211; 1906. ♀.

♀. Not stout. Anterior margin of clypeus broadly subtruncate, slightly produced mesad, not dentate laterally, very closely punctate at base; antennæ moderately slender, joint two about one-half the length of 3, which is three-fourths of 4; interocular space about equal to joints 2-4; frons finely and shallowly granulate, becoming separate punctate towards ocelli; vertex with sparse punctations, ocellar line deep, a shining fold behind each posterior ocellus has somewhat the appearance of a second pair of ocelli; vertex depressed a little below the level of the eyes; thorax polished, with rather fine, shallow and separate punctures; disc of propodeum moderately granulate, with an indication of a median impressed line, sides shining, shallowly fine-punctuate or imperfectly reticulate, the posterior face shining, nearly smooth, with a deep wedge-shaped fovea; legs feebly spinose; venation rather weak, the marginal cell rather narrowly and very little obliquely truncate, second submarginal cell a little wider than the third along the radius; pygidium well defined, hardly two times as long as its basal width, sparse punctate, very little constricted preapically. *Black;* legs dull brownish apically; abdomen red, largely black on the ventral segments 1-5; apex of pygidium dark brown. Pile sparse except on face. Length, 7 mm. (type).

One ♀; Clark county, Kansas; May; F. H. Snow.

"Related to *terminatus*."—Vier.

Tachysphex quebecensis (Prov.).

Larra quebecencis Prov.; Faun. Ent. Can., II, 633. ♂ ♀.

Tachysphex quebecencis Fox; Proc. Acad. Nat. Sci. Phil., 527-8; 1893. ♂ ♀.

This species is reported by Bridwell, who collected it near Baldwin, Douglas county, Kansas.

Tachysphex æthiops (Cress.) ♂ is reported from northwestern Kansas, September, 1877 (S. W. Williston, Coll.) by W. H. Patton (Bull. U. S. Geol. and Geog. Sur. Terr., V, No. 3,349-70; 1879-'81.) His description of the specimen, however, is far from agreeing with that of Fox for the ♂, and leads me to believe that the insect taken in 1877 is really a *Larropsis*, which fits in description, as far as it goes.

Tachysphex minimus (Fox).

Tachytes minimus Fox; Trans. Am. Ent. Soc., XIX, 248; 1892. ♂.

Tachysphex minimus Fox; Proc. Acad. Nat. Sci. Phil., 532-3; 1893. ♂.

Bridwell (Kan. Acad Sci., 208; Dec., 1898) reports this insect from Kansas. The abdomen varies from entirely black to red at the base. It occurs also in Nebraska.

LYRODA Say.

Say; Jour. Nat. Hist., I, p. 370; 1836.

Form rather slender, sparsely pubescent. Head distinctly wider than thorax, long and evenly rounded; antennæ medium, scape rather stout; eyes not converging, their inner margins parallel; three round ocelli, arranged in a low triangle; mandibles emarginate beneath and dentate within. Thorax slender, due largely to the rather long, narrow pronotum which is medially produced posteriorly (subtuberculate); propodeum rounded-truncate, with a more or less evident carina at its dorsolateral angles (this carina is present at least at the apex); marginal cell of fore wings truncate and distinctly appendiculate, second submarginal cell not petiolate; legs rather long, spinose. Abdomen rather narrow, fusiform, first abdominal segment slender, more gently rounded and well tapering.

♀. Fore tarsal comb not strong; pygidium well defined, rounded-triangular, and covered with short pile.

♂. Fore femora entire; pygidial area hardly defined, pubescent.

KEY TO THE SPECIES OF LYRODA.

Form stout; color deep black, without silvery pile on abdomen; wings dark fuscous; length, 14-15 mm.....*triloba* ♀

Form rather slender; not *deep* black; silvery pile on abdomen; wings dusky only at tip; length ♂, 7-8 mm.; ♀, 11-13 mm.....*subita*

Lyroda subita Say.

(Fig. 96, pygidium, ♀.)

Lyroda subita Say; Jour. Nat. Hist., I, p. 372; 1836. ♀.
Lyroda subita Fox; Proc. Acad. Nat. Sci. Phil., 533-4; 1893. ♂ ♀.

A small series of both sexes; Douglas, Norton, Rooks, Trego and Decatur counties; June-August.

Lyroda triloba Say.

(Fig. 37, ocellar area.)

Lyroda triloba Say; Jour. Nat. Hist., I, p. 372, 1836. ♀.
Lyroda triloba Fox; Proc. Acad. Nat. Sci. Phil., 533-4, 1893. ♀.

2 ♀ ♀; Clark and Smith counties; August-September.

Seemingly a rare insect. I find no record of the ♂.

PLENOCULUS Fox.

Fox; Psyche, VI, 554; 1893.

Head wider than thorax; eyes converging towards vertex; antennæ short, stout and subclavate; ocelli round, arranged in a subequilateral triangle; mandibles strongly excised beneath, dentate within. Pronotum below the level of the scutum; propodeum short; marginal cell truncate, second submarginal cell petiolate, first and second submarginals each receiving a recurrent nervure, submedian cell shorter than the median cell on the externo-median nervure; legs stout and spinose.

♀. Pygidium well defined, naked and broadly triangular.

♂. Pygidium smaller and less distinct in this sex; eighth ventral segment rounded out or at most slightly emarginate.

A genus represented by small species, of which there are about a dozen in the United States.

KEY TO THE SPECIES OF PLENOCULUS.

Abdomen black ..... *davisi*
Abdomen red, black apically ..... *apicalis*

Plenoculus davisi Fox.

Plenoculus davisi Fox; Psyche, Nov. 1893, p. 554.
Plenoculus davisi Fox; Proc. Acad. Nat. Sci. Phil., 537; 1893. ♂ ♀.

♀. Clypeus emarginate mesad; three to five lateral teeth; thorax minutely punctate; propodeum finely granulate, a median impressed line and some short transverse striæ at base, sides delicately striate. *Black;* mandibles, except tip, tegulæ, tibiæ and tarsi, more or less yellowish, abdominal segments apically testaceous, the last segment reddish at tip. Length, 5-6 mm.

♂. Anterior margin of clypeus strongly rounded out or slightly produced mesad; ventral abdominal segments 3-6 with a transverse row of tubercles. *Black;* clypeus and scape beneath, tubercles, tegulæ and disc of prothorax, apex femora, tibiæ except the inner side of the two anterior pairs, and tarsi, bright yellow. Length, 4.5-5 mm.

Structurally much like *propinquus* and *apicalis*.

A single ♂ taken in Graham county, August 16, 1912, seems to belong here. The clypeus has its lateral angles sharp, the median portion produced much as in *apicalis*, and the light yellow markings, disposed rightly for the species, are here light yellowish-brown to brownish instead of yellow. Length, 4.25 mm.

Plenoculus apicalis n. sp.

(Fig. 20, wings; 43-45, antennæ; 76 and 77, clypeus; 102, pygidium, ♀; 103, tip of ♂ abdomen.)

♀. Anterior margin of the clypeus with four, or an additional fifth tooth on each side of the median emargination; front finely granulate; median impressed line from behind fore ocellus not extending to base of antennæ, where it is partly replaced by a raised line; a short curved furrow between each posterior ocellus and eye; first joint of flagellum a very little shorter than either second or third; scutum and scutellum with fine, close punctures, the sides finely and indistinctly granulate-striate; disc of propodeum finely granulate, the strong median furrow traversed by a few separate and indistinct striæ; the disc largely naked, its base with some short radiating striæ, the sides about like the thorax, posterior face with a wedge-shaped depression and polished median impression within; legs stout, rather spinose, tarsal comb moderate, the spines thereon about as long as the diameter of the first tarsal joint; venation normal; abdomen inpunctate, except toward the apex (at the origin of the hairs); pygidial area shining, sparsely large-punctate, the bounding carinæ low. *Black;* mandibles, except tip and lower edge, yellowish to

brownish; apex of scape beneath narrowly yellowish; wings clear, iridescent, venation testaceous, the tegulæ paler; apex of fore femora, fore tibiæ except beneath, and the upper basal portion of middle and hind tarsi, pale yellow; tibiæ brownish; first two or two and one-half abdominal segments clear red, the black on apical segments often more extended ventrally, apical margins of segments more or less testaceous, tip of pygidium reddish. Appressed silvery pile plentiful. Length of type, 4.25 mm.; range, 3.50-4.75 mm.

Phillips county, Kansas; August 30, 1912.

♂. Like the ♀ in many respects. Clypeus rather narrowly subtruncate mesad, the truncation itself a little produced in the middle, no lateral teeth; propodeum usually a little more coarsely sculptured than in ♀; abdomen more pilose, ventral segments 3-6 tuberculate; the clypeus is yellow, the second abdominal segment above often with a black band and a few spots of the same color ventrad, last segment often reddish. Facial pile frequently with a golden tinge. Length, 3.50-4.25 mm.

Twenty-two ♂♂ and fifteen ♀♀; from Norton and Phillips counties; end of August, 1912.

♂. *Var.* Yellow markings replaced by reddish brown; the last four segments are blackish, the rest have some large spots of the same color. Facial pile more silvery than in the usual form.

One ♂; Graham county; August 16, 1912.

Apparently most closely related to *davisi*, from which it differs in color and in being smaller. The clypeal margin in the ♂ is subject to a little variation.

Niteliopsis Saunders.

Saunders; Trans. Ent. Soc. London, III, p. 410; 1873.

Small insects, nearly naked or covered with short pile. Head rather long, wider than thorax; antennæ slender to quite stout and subclavate; mandibles not or very slightly emarginate beneath; eyes rather strongly converging to the top; three perfect ocelli. Thorax stout, fusiform; propodeum rounded posteriorly; legs rather feebly spinose; marginal cell rather elongate, truncate, the appendiculation rather obscure, second submarginal cell petiolate, the transverse-median and recurrent varying in relative position.

♀. No tarsal comb; pygidial area pilose, poorly or not defined.

♂. Fore femora simple beneath at base; no pygidial area; eighth ventral segment at least sometimes emarginate.

The four Kansas species do not readily fall in this genus. Using Ashmead's key, and granting first of all that the insects have a distinct pygidial area (which is not evident to me), *foxii* would run to the genus *Niteliopsis*, while the rest, on the same condition, would run to *Silaon*. All of our species have been placed in the latter genus by Rohwer (Proc. U. S. N. Museum, vol. 40, 586; 1911). Here the question hinges on the species not having the mandibles emarginate exteriorly (*Silaon*), or having the mandibles distinctly or shallowly emarginate exteriorly. The author is not sufficiently acquainted with the group to arrive at any definite conclusion in the matter than to state that the group to which *Nit. foxii*, *vierecki*, and probably *fossor*, belong, differs widely from the rest and should

be separated therefrom. The three above mentioned are nearer the Larrinæ than the rest, and differ a good deal in the antennæ, venation, etc. (See figs. 29 and 30.) Whether the camera lucida drawing of the mandible of the type of *Nit. foxii*, fig. 28, shows this mandible to be shallowly emarginate or not emarginate exteriorly would be hard to decide. The writer can do no better than to include all the Kansas species under the genus *Niteliopsis* in awaiting a more perfect arrangement of the group than the present.

KEY TO THE SPECIES OF NITELIOPSIS.

1. Second joint (pedicel) of antennæ about one-half or less the length of the third, which is at least three times as long as its apical diameter (fig. 29); antennæ not at all clavate; first recurrent nervure running well into the second submarginal cell (fig. 18); abdomen red ..... *foxii* ♀

   Second joint of antennæ from one-half the length to as long as the third joint, which is not more than two times its apical diameter; antennæ somewhat clavate (fig. 30); second recurrent nervure running into the first submarginal cell, or at most just received into the second submarginal; abdomen black 2

2. As viewed from above (under a compound microscope), abdominal segments 1 and 2, at least, are finely reticulate or appear scaled, the punctures for the reception of the pile being very shallow and therefore not pit-like; abdomen evenly rounded; females 4.25 mm. or less long, males 3 mm. long..... *affinis* ♂ ♀

   Abdominal segments 1 and 2 with deep separate punctures, therefore not reticulate; abdominal curve somewhat interrupted by the intersegmental constrictions; length, 4-6 mm. 3

3. Pronotum, postscutellum and all the tibiæ marked with creamy yellow; transverse-median vein commonly arising beyond the basal vein; disc of propodeum without a distinct, broad and bounded sulcus apically, and with well-separated longitudinal to somewhat diverging striæ, reaching usually to apex; no transverse apical striæ ..... *inerme* ♂ ♀

   Pronotum and sometimes apex of tubercles of pronotum with creamy yellow, or the pronotum all black; transverse-median vein basad of or interstitial with basal vein; disc of propodeum with a well-marked broad apical sulcus, and with a few short or indistinct striæ from the base, transverse apical striæ present. *kansensis* ♀

Nit. sayi of Colorado is sculptured on the abdomen like *affinis*, while *niger*, from the same locality, resembles *inerme* in that respect.

Niteliopsis foxii Vier.

(Fig. 18, venation; 28, mandible; 98, pygidium.)

Niteliopsis foxii Viereck; Trans. Am. Ent. Soc., XXXII, 207-8; 1906. ♀.

The type comes from Clark county, Kansas; June; F. H. Snow. Another ♀ was taken in Haskell county; July, 1911. It was running over the ground, now and then entering holes and crannies. The species is very close to if not identical with *N. vierecki* Roh., which occurs in Colorado.

Niteliopsis affinis Roh.

Niteliopsis affinis Rohwer; Trans. Am. Ent. Soc., XXXV, 113-4; 1909. ♂ ♀.

This is a very small, shining black species, described from Colorado. It seems rare in Kansas, where it was taken in Graham, Norton, Ellis, Ness and Rush counties; June-August, 1912.

Niteliopsis inerme (Cress.).

Nysson? *inerme* Cresson; Trans. Am. Ent. Soc., IV, 224; 1872. ♀. Tex.
Niteliopsis inermis Rohwer; Trans. Am. Ent. Soc., XXXV, 110-11; 1909. ♂.

A good series from western Kansas; Grant, Barton, Norton, Phillips, Ellis, Ness and Rush counties; June-August. The insect is rather easily recognized by its pale yellow markings.

Niteliopsis kansensis n. sp.

♀. Anterior margin of clypeus narrowly lobed mesad; antennæ subclavate, joint 2 stouter than either 3 or 4; 3 and 4 subequal, the fourth narrow at the base; front not very finely granulate-punctate, the carina to clypeus distinct, a slight impressed line from ocellus forward; vertex granulate-punctate, scutum moderately so, the pleuræ inclined to be coarse-punctate; disc of propodeum coarse-rugose, with indications of longitudinal striæ at the base; a broad, rough, moderately deep fovea for more than the apical half of the disc, some coarse transverse apical striæ, sides finely striate, posterior face granulate-striate, a strong median fovea; legs feebly spinose; second recurrent nervure received in the second submarginal near its tip; transverse-cubital vein arising a little basad of the basal vein, marginal cell narrowly truncate. Segements of the abdomen somewhat constricted basally, basal segments most distincly punctate; pygidial area lacking. *Black;* mandibles rather dark rufous near the middle; tubercles, a spot posteriorly on each side of the median line of the pronotum, apex of femora (and also the middle femora very slightly), and the hind tibiæ at their base outwardly, yellow; clypeus and lower part of the face, thoracic pleuræ and sterna, silvery pilose; abdomen somewhat pilose. Length, 4.75 mm. (type).

Norton county, Kansas; August, 1912.

A second ♀ is entirely black, excepting for the apical portion of the tubercles. This, the cotype, is from Barton county; June 22, 1912. It is allied to *plenoculoides* and *niger;* from the first it differs in being smaller, in lacking the carinate pronotum, in having a coarser sculpture on the propodeum, and a somewhat different venation; from *niger* it may be distinguished by the finer punctation and in not being all black (except for a portion of the mandibles).

MISCOPHUS Jurine.

Jurine; Nouv. Meth. Class. Hym., p. 205.

Head wider than thorax; mandibles strongly excised beneath, not dentate within; antennæ quite slender. Marginal cell lanceolate, not appendiculate; two submarginal cells, each receiving a recurrent nervure; armature of legs variable. No pygidial area.

♂ Has a feebler tarsal comb and stouter antennæ than the ♀.

The genus is poorly represented in the United States.

Miscophus americanus Fox.

(Fig. 75, clypeus, ♀.)

Miscophus americanus Fox; Ent. News, I, 138; 1890; ♀. II, 196; 1891; ♂.

This is a small black insect, 3 to 4.5 mm. long, having the clypeus three-lobed, the wings infuscated apically, and the abdomen shining. The type was taken in Camden county, New Jersey. The three ♂ ♂ and one ♀ in the Snow collection come from Rush and Barton counties; June, 1912.

BOTHYNOSTETHUS Kohl.

Kohl; Verh. Zoöl.-bot., Gesell. Wien, p. 344, taf. XVIII, f. 5 *et* 6; 1883.
Fox; Proc. Acad. Nat. Sci. Phil., 550; 1893.

Body stout. Head as wide or wider than thorax; eyes diverging towards vertex; antennæ rather stout; ocelli large, arranged in a low triangle; mandibles not emarginate beneath. Pronotum almost on the same level as the scutum, which is large; propodeum rather short; stigma of primaries quite large, marginal cell lanceolate at apex, no appendiculation, first submarginal cell very large, the second petiolate, receiving one or both recurrent nervures; submedian and median cells of the same length on the externo-median nervure; legs stout, feebly armed, hind femora broadest apically. A broad and well-defined pilose pygidial area in both sexes.

As far as I am aware, this genus is represented in the United States by a single species. It is an anomalous larrid, and seemingly far removed from any other genus of the family. The large stigma of the fore wings resembles that of some of the Pemphredinidæ. The apically thickened hind femora easily separates it from the other genera.

Bothynostethus distinctus Fox.

(Fig. 17, venation; 50, disc of propodeum, ♂; 74, clypeus, ♂; 86, hind femora, ♂; 95, pygidium, ♂.)

Nysson distinctus Fox; Ent. News, II, 31; 1891. ♂ ♀.
Bothynostethus distinctus Fox; Proc. Acad. Nat. Sci. Phil., 551; 1893. ♀ ♂.

Two ♂ ♂ of this shining black wasp were taken in Logan county, end of June, 1910. They are 5.50 mm. long. The insect seems quite variable, both the venation and the margin of the clypeus differing in the two Kansas specimens. The venation as illustrated in figure 17 does

not quite agree with that as given in Fox's diagnosis of the genus. The peculiarly and strongly sculptured propodeum should serve to distinguish *distinctus*.

The insect is well distributed in the United States.

Recapitulation and Comment.

The Larridæ of Kansas number fifty-eight species, which are included in ten genera. All but two of these species have been taken within the state by the Biological Survey of Kansas University, between the years 1875 and 1913.

The following table shows what proportion of the Larridæ of the United States, as represented by the ten genera, is possessed by Kansas. The varieties are omitted here.

Genus.	Number of species. U. S. Larridæ.	Kansas Larridæ.
1. Larra	1	1
2. Notogonia	3	1
3. Larropsis	21	12
4. Tachytes	31	12
5. Tachysphex	69	22
6. Lyroda	2	2
7. Plenoculus	12	2
8. Niteliopsis	13	4
9. Miscophus	2	1
10. Bothynostethus	1	1
Total	155	58

The above enumeration may be a little underestimated. It is possible that a few species (under these ten genera) have been omitted. There is no doubt, however, that inasmuch as in many instances species are described from one sex only, or by comparing the insect with the descriptions only instead of with known or related species, the list is not free from synonyms. As far as undescribed material goes, there is a good deal of such in various collections in the country. There are a few genera of Larridæ in this country, such as *Miscophinus* and *Pisonopis*, which have not as yet been reported from this state; these represent comparatively few species, however, and should, even with their addition, still maintain the total number of species for the United States below the 200 mark.

Of the Kansas species, thirteen are described here as new. Of these nine belong to the genus *Tachysphex*, two to *Larropsis*, and one each to the genus *Plenoculus* and *Niteliopsis*.

Miscophus and *Plenoculus* are now reported from Kansas for the first time.

The Larridæ of the genus *Tachytes* include our largest and most bee-like species. *Tachysphex,* though by far the best represented of the genera, is made up of rather inconspicuous wasps which can be secured in variety only by dint of close collecting. Genera such as *Niteliopsis, Plenoculus* and *Miscophus* are composed of small forms; it is by reason of this diminutive size, their activity, as well as special habitat, that many more species will eventually be discovered.

The Larridæ of the United States range from 3 mm. to about 23 mm. in length.

The ocelli or simple eyes present characters of first importance within the family; the mandibles perhaps stand next in order; which is the case because these two organs are similar or nearly so in both sexes. Venation, while of great importance within the family, is often variable, particularly in the smaller forms. Considered on a broad basis, the above characters may be said to be of supergeneric value.* The more relative form and position of the ocelli, the variation in the mandibles, legs, venation, pygidium, eighth ventral segment (♂), the convergence or divergence of the compound eyes, are commonly of generic importance. The often pronounced sexual differences, found, for example, in the antennæ, pygidium, armature of legs, and the clypeal outline, are of generic and specific value. It is owing to these marked structural as well as color differences, and to the frequent absence (apparent or real) of good characters common to both sexes, that renders impracticable, in those genera containing a goodly number of species, the construction of one specific key to include both sexes. Very important specific characters are: The character of the anterior margin of the clypeus; the width of the interocular space at the vertex; the distinctness, shape, armature and punctures of the pygidium; the comparative length of the antennæ and their joints, as well as the form of any of the latter; the sculpture of the head, thorax and propodeum (closeness and size of the punctures, striations, granulation, etc.), and the color. The latter, while remarkably constant in some groups, is quite variable in others, and should therefore be used with care.

* There may prove to be characters even more far-reaching than those just mentioned (and as suggested by certain writers) to be found in the sternal region of the thorax. The mouth parts, which for their proper study would require careful and tedious dissections, could possibly furnish clews as regards the status of the Larridæ.

The Larridæ are accorded different values by different authors. By some they are treated as a family; by others they are given subfamily rank. All are not agreed upon what genera should be included and what excluded from the group. While this state of things may in part be the resultant of insufficient study and faulty interpretation, it can also follow from the continuity of Nature, in that it does not always permit of well-defined divisions to be made in its realm.

PART III.

Studies on the Biology of the Kansas Larridæ.

The very general and fragmentary nature of our knowledge concerning the habits of the North American Larridæ has induced the author to publish the results of his observations on this group of insects. These studies are quite incomplete, since they embrace but a small proportion of the Kansas species, and treat almost solely of the habits of the adults, for while the actions of the latter were in many cases observed in detail, the early stages have been practically neglected.

The entomological division of the Biological Survey of the University of Kansas made collections in the northwestern portion of the state during the summer of 1910, in the southwestern area in 1911, and in the north central part in 1912. Not very much attention was given the Larridæ during the first of these surveys; in 1911, however (when the writer decided to monograph the Kansas forms), the habits of several species were studied in detail and a large series of the insects secured, while during the ensuing year I was enabled to make numerous additional observations.

Ever alert and watchful in the hot sunshine, the Larridæ are among the swiftest of insects, and readily evade any incautious attempt on the part of the collecter to secure them; on cool, cloudy days they are quite sluggish, and certain species, largely males, may then be taken on various flower heads. In the western portion of the state, species, mostly of the genus *Tachytes* and *Larropsis,* appeared to favor the blossoms of snow-on-the-mountain (*Euphorbia marginata*) and stinking clover (*Cleome serrulata*), both of which occurred in large patches, while the Russian thistle (*Salsola*) and a small prostrate species of *Euphorbia,* found in sandy situations, proved attractive to others. The latter plant was found to harbor the smaller Larridæ, such as those of the genera *Tachysphex, Niteliopsis,* and *Plenoculus.*

Many of the Larridæ, particularly of the genus *Tachytes,* which contain some of our larger forms, produce, when on the wing, a high-pitched buzz, sufficiently characteristic in a few

species to enable the listener to distinguish between them. Thus *Tachytes mandibularis* has a higher-keyed hum than the larger *T. distinctus*. The hum of these wasps is therefore of great assistance to the observer who is desirous of seeing them hunting their orthopterous prey; for whereas the wasp is often lost to view while flying among the weeds, her audible buzz enables one to follow her with some degree of certainty.

Some, notably *Tachytes*, commonly fly quite far from their burrows in search of their prey, while many of the *Tachysphex*, having shorter wings but longer legs than the species of the foregoing genus, are largely cursorial, and seek their victims at no great distance from their tunnels, and, since these wasps seldom move far in a straight line, their course will often bring them again before their nests.

Prey.

The prey of the Larridæ consists very largely of orthopterous and hemipterous insects. These wasps are therefore of some economic importance. Where the insect attacked is an orthopteron, it may frequently be far larger than its aggressor (fig. 112), and is then able to offer it stout resistance before being subdued, and not infrequently escapes altogether. In other cases the fated victim is no match for the wasp, which, clasping it with its legs, readily administers the fatal sting under the thorax.

As a consequence of an older and more peopled country, the Larridæ, in common with many other groups of insects, have been better studied in Europe than in America. In the former country, Fabre observed *Tachytes obsoletus* provisioning its nest with the larva of Œdipoda. *T. tarsina* captures a larval acridian, while *T. pompiliformis* seems to furnish her progeny with a more diversified menu, having been seen by different entomologists to capture lepidopterous larvæ, as well as Orthoptera of the families Acridiidæ and Gryllidæ. Sharp (Camb. Nat. Hist. Ins., pt. 2, p. 117; 1901) speaks of "a species of *Tachytes* in the south of France," which selects as its prey one of the ferocious Mantidæ, stinging this capable insect, at an available opportunity, in the "nerve center between the formidable arms; . . . subsequently the *Tachytes* paralyzes each of the other pair of legs, and then carries off its victim." *Larra anathema*, a large and powerful species of the Old World, provisions its nest with mole-crickets. The

small wasps of the genus *Miscophus* have been noted to prey on spiders; this also holds true of our species in this genus, so far as observed.

The writer has had access to but a small portion of the European literature relating to fossorial wasps.

In America, *Tachytes harpax* and *mandibularis* use Locustidæ of the genus *Xiphidium*. Acridiidæ furnish the prey of the other species of the genus, in so far as it was noted. The *Tachysphex* were observed to seek Acridiidæ, which may be of the subfamilies Acridiinæ, Tryxalinæ, or Œdipodinæ. An *Iachysphex hitei* Roh., in the collection of the U. S. National Museum, was captured with a young cursorial mantid, *Litaneutria minor* Scudd. An interesting observation has been made in Texas by Hartman, who took *Tachysphex texana* in the act of capturing a fly larger than herself. (See Bull. 65, Scientific Series, U. of Tex., p. 55-6; 1905.) The other genera of Larridæ furnished, on the whole, rather fragmentary data as regards their prey. In the case of *Notogonia argentata*, young Gryllidæ are used; some of the *Larropsis* prey upon *Ceutophili* (Locustidæ), while *Plenoculus* and several of the *Niteliopsis* store their nests with small Heteroptera. It is to be noted that the prey of some certain one of these wasps is frequently limited only to a family of insects, and that therefore these "fossorials" are not as select as regards their victims as is often held to be the case.

Nests.

According to my observations, the Larridæ almost invariably excavate their own burrows. On rare occasions they were found to have taken advantage of a crack, and perhaps also of a strange tunnel, to lessen the work of digging. A few of the smaller species make their nests in brambles, but the great majority burrow in the earth. *Tachysphex* digs shallow one-celled tunnels, and must often make several in one day. *Tachytes* and *Notogonia* make far more elaborate burrows, which are deeper and contain from a few to many cells. Supplying such nests as these requires several days, and in certain cases perhaps as much as eight or ten. The very incomplete observations on the genera *Larra, Larropsis, Plenoculus* and *Lyroda* seem to indicate that their nests are neither dug nor provisioned in a single day.

Oviposition.

Except in the case of *Miscophus,* the egg of the Larridæ is placed transversely, or nearly so, across the base of the prothorax of the orthopteron or hemipter, as the case may be, and is securely fastened at its cephalic end in the soft membrane, behind* and a little inside of one of the fore coxæ. It may be well to mention here that *Prionony x,* one of the Sphecidæ which preys on Orthoptera, glues her egg on the membrane at the exterior base of one of the *hind* coxæ, the egg lying along the base of the posterior femur, instead of across the thorax, as in the first case. In either case, however, it is well protected by its position from any movement which the often sprightly entombed victim may make. According to Ferton (Actes de la Soc. Lineenne de Bordeau, xlviii, 266-8; 1895), the egg of *Miscophus bicolor* is secured to the anterior face of the spider's abdomen, and is vertical in position.

The Larridæ do not display as much specialization in nidification, perhaps, as do many of the Sphecidæ, and far less than is exhibited in the Eumenidæ. They are, however, persevering workers, and at times show much valor (if such it may be called) in attacking their often huge prey.

Habits of the Males.

The foregoing remarks apply solely to the female Larridæ, for seldom, if ever, do the males assist in the work of nidification, and, not being furnished with a sting, are wholly incapable of subduing such an insect as is overcome by the female.

While it is true, generally speaking, that the males are seen more frequently than the other sex, the explanation of this may be found in the habits of the former. They are often found at flowers, or resting on a tree trunk, whence they make frequent sallies at passing insects, much in the same manner as some of the more pugnacious butterflies. The above applies largely to the genus *Tachytes.*

A few *Larropsis* males can be taken at flowers; it is likely, however, that they occur in greater numbers in the vicinity of holes made by various animals, such as rabbits, gophers, and badgers. In the walls at the entrance of such burrows numer-

* The Peckhams (Wasps Social and Solitary, p. 263; 1905) speak of a *Tachysphex (Larra) quebecensis* storing her nest with several little grasshoppers and laying the egg *in front* of the first pair of legs. C. M. Weed, in his Life Histories of American Insects, p. 150, fig. 55, shows a young tryaline locust with a *Tachysphex* egg placed behind the fore coxæ.

ous small galleries may be found, and these are frequently entered and enlarged by such *Larropsis* as *ater* and *bruneri*. It is certain that some of these holes are made by the male insects, probably as a place of retirement during unfavorable weather and at night. A black species of *Tachysphex*, probably *fusus* or *terminatus*, was observed digging a hole in the sand during the hot afternoon hours, closing its retreat from within. *Plenoculus apicalis* and *Niteliopsis affinis* have much the same habits as the above.

Enemies of the Larridæ.

Among the enemies of the adult wasps may be mentioned: Asilidæ, or robber flies, which are very abundant on the Great Plains, and which capture the largest Larridæ; various species of ants, which, roaming everywhere, have been seen to cause considerable annoyance to the wasp as she was digging, and at times they took possession of her prey; lizards are probably a source of minor hazard, in that they give chase to the wasp while dragging her heavy load over the ground. Small tachina flies destroy large numbers of wasps by appropriating the food of the hymenopteron for their own young.

Stinging and Malaxation.

It would appear that the Larridæ, and probably numerous other wasps as well, sting their victims not primarily for the purpose of giving them their quietus, so that their offspring may feed with safety thereon, but in order that the wasp herself may successfully manipulate her prey, and suffer the least inconvenience, delay or injury thereby. When a little *Tachysphex*, for example, attacks an acridian far larger than herself, or the sphecid *Prionony*x pounces upon a large *Melanoplus* or *Mermiria*, as often happens, it would seem logical that in the violent struggle which ensues that the wasp seeks to overcome her prospective victim as speedily as possible. The more time employed in this rough occupation, the greater the opportunity for the grasshopper's escape, and so the wasp endeavors to quiet it with a well-directed sting under the thorax, presumably penetrating one of the large ganglia of that region. Usually, if not always, one or more subsequent stings are given, these, perhaps, with a view to the welfare of the young. But it must be confessed that some of the entombed victims may become exceedingly lively if taken out and disturbed, though they seem to have lost the sense of direction and co-

ordinate action. Again, I have found fresh as well as putrefying Orthoptera in a single closed cell, showing that the wasps administer their stings with varying degrees of certainty, sometimes with the effect of killing, at other times only paralyzing. Furthermore, the egg is placed in such a secure position that it can not be readily if at all dislodged by any movement of the victim, and the larva, on hatching, remains for some time in the same position as the egg.

Malaxation.

A number of species of wasps have been observed by different entomologists to "malaxate" their prey after it has been stung. To malaxate (*malasso*—to knead, to soften), as referred to these insects, consists in that process of biting or chewing at their victims for a purpose which, to my knowledge, has not been satisfactorily explained. The procedure has been carefully observed by Marchal, in Europe, who considers it very important. He noted it in the case of the philanthid wasp *Cerceris ornata,* which pricks and squeezes the neck of the bee *Halictus,* licking off the juice which exudes. In this case malaxation was found to quiet the victim more than if merely stung, having therefore a tendency to shorten its life.

I have seen *Notogonia* and *Tachysphex* and *Tachytes* bite the prosternum of their prey, going as far as the mouth of the prostrate insect. In one case the wasp remained with its distended jaws applied the orthopteron's neck, suggesting, perhaps, that she was lapping up a liquid. Ferton is of the opinion that *Miscophus* malaxates her spider prey to obtain such a fluid. It is doubtful, however, if the wasp's jaws are always sufficiently powerful to draw out any nourishment in that manner. Malaxation, as the Peckhams have observed, is not done in every case. It would seem, therefore, to be secondary in importance to the act of stinging, and appears to be of doubtful purpose.

Habits of the Species.

Typical Larridæ, or Larrinæ.

(With only one perfect ocellus.)

Larra americana Cresson.

The above insect, as far as I can ascertain, is the same as *Larra analis*, our large shining species. Hartman (Bull. Univ. of Tex., No. 65, pp. 61-62; 1905) has found *americana* provisioning its several-celled burrow with crickets. The wasp has a peculiar way, we are informed, of digging her nest, backing out and using her head and fore legs as a kind of scraper. The insect is rare in Kansas, where nothing was observed of its habits.

Notogonia argentata Bve. (Fig. 118, egg *in situ*.)

This rather long-legged wasp was studied on the University campus, at Lawrence, at the end of August, 1911. Considerable time was spent in locating the burrow, but the first insects observed gave me no results aside from noting that, from their habit of investigating holes and crannies, the prey should probably be one of the Gryllidæ. This surmise was soon verified when at 2 P. M. September 2 a *Notogonia* was seen flying about the stone steps of the Museum building, carrying under her body a young *Gryllus* about the size of an ordinary *Nemobius* cricket. She let go her prey at my approach, but soon grabbed it again by the base of the antennæ, and, taking wing, flew about the steps and cement walk in a rather undecided manner. She appeared either to have lost her nest or to be searching for one, for she fussed around for fifteen minutes, never letting go of her burden the while, attempting at times to enter cracks which were not sufficiently spacious to admit both cricket and wasp at one time. Finally, at 2:15 P. M., she dropped the *Gryllus* and entered the crack, but on coming out after a stay of half an hour the orthopteron was totally ignored. At about this time another wasp of the species was flying about near by. She would alight, pick up a pebble in her mandibles, to drop it again, having to all appearances no definite aim. At 3:10 P. M. a third *Notogonia* was seen to fly heavily with a cricket about as large as herself, alight near a crack in the cement walk, and run into this crevice with her prey beneath her. This being forbidden ground for the knife and trowel, I searched the earthy slopes along a very small stream which flowed through the golf links near by.

Here, on September 4, I located what seemed to be a small settlement of these wasps, the males being the ones more commonly seen. At 2:45 A. M. I watched a *Notogonia* hunting about the grass near a bank of loose earth. On the whole, her movements were not as quick as those of *Tachysphex,* excepting, perhaps, when she shifted her hunting grounds by a rapid little flight. Now and then she would stop and pry under the dead and flattened grass, with the effect, at 2:45 P. M., of arousing a young *Gryllus.* The latter, by means of continued and vigorous hopping, made good its escape, her enemy searching about excitedly in the meantime. At a favorable opportunity I caught the fugitive and let it fall near the wasp. She pounced upon it like lightning, and stung it immediately, apparently under the thorax. After cleaning herself, as usual, with her fore legs, she seized her prey, and, turning it over on its dorsum, chewed at its soft neck. This operation completed, the young *Gryllus* was placed on its venter again, and, *Notogonia* striding it, seized it by the base of the antennæ, and, by a series of runs and short jumps, with an occasional rest, she carried her booty in a good straight line for a distance of thirty feet, to run at 3:03 P. M. into a hole in the bank. The opening was somewhat concealed, and was placed at about two vertical feet below the grassy area. There was no soil heap before it, as in the case of the tunnels of *Tachysphex,* and it seemed probable (after digging out the gallery) that it had been only partly excavated by the wasp in question. *Notogonia* remained within for a minute or two, coming out to walk in the vicinity for a longer period. Reentering at about 3:09, she did not appear until 3:30. She was probably working on a cell during the interval, for at 4:05 she was biting out small lumps of earth at a distance of two or three inches from the hole. Working thus for a short time, she entered, to remain within until 5:10, when she emerged, seized a little stick in her jaws and brought it in her burrow. At 5:25 she was still inside, and probably passed the night in that security.

At 9 A. M. the next morning I saw her enter her burrow, and at 9:30 she was hunting in various holes and about grass clumps, four or five feet from the nest. At 9:35 she attacked a small *Gryllus,* which leaped valiantly, but this time to no

avail, for it was soon rendered helpless by a sting under the thorax. It was malaxated on the ventral side of the neck, as in the first instance, and carried venter down. The wasp made little runs and short flying jumps from grass blades with her burden, and though very near her burrow, took considerable time in locating the same, which she entered at 9:40. Five minutes later she came out, and after a short pause took wing, but returned unnoticed. At 10:08 she was very busy filling up her tunnel, working rapidly, gathering little lumps of earth and other material, such as twigs, thorns, and Orthoptera excrement. This material, though varied in character, was selected with some care, and at first brought in from some little distance. Her first trips averaged a little more than two per minute; her final ones (which were made mostly on the wing), from six to seven per minute. Shen then remained inside for a little more than twenty minutes. As the burrow became filled her trips for material were more hurried and shorter, and instead of picking up loose earth she would frequently bite off a piece, for a time, from two separate places a few inches away. At 11:18 her burrow was so shallow that when she entered she could be seen within depositing her load, occasionally emitting a squeaky little buzz. She seemed to become rather excited as her work neared completion, being then somewhat easily frightened, and at a movement from the observer would turn about and regard him doubtfully, as it were. She frequently carried lumps of earth of at least her own weight. None of this material is tamped down, but lightly placed at the bottom of the tunnel. The *Ammophilas* and *Isodontias* among the Sphecidæ, and many of the larrids, pack the soil, at least when their burrows are nearly filled. At 11:35 A. M. *Notogonia*, having finished the work of filling the burrow and disguising the site, flew away. The location of the tunnel was thus fairly well hidden, largely by excrement; in addition there were a few twigs and some soil. Its diameter at the entrance was one-half inch high by nine-sixteenths of an inch wide. The earth packing extended only for an inch or two below the surface. The shaft, at first subhorizontal and widened in an irregular manner, soon narrowed and sloped quite steeply. I soon lost the main tunnel, but upon digging deeper found three neat shafts, each terminating in a rounded cell. The first of the latter was at a depth of about five inches

and seven from the mouth of the main tunnel. It contained an immature *Gryllus,* with the smooth, shining, whitish *Notogonia* egg transversely arranged on the prosternum (fig. 118, *E*). The second cell was similarly provisioned, while the third yielded two crickets, one of which was quite small. One of the victims from this nest was decidedly active when touched, though its leaps were neither continued nor well directed. Digging still deeper revealed no further cells.

There are several things worthy of note regarding the habits of this insect. Although not seen in the act of excavating her burrow, she never used her feet in filling up the hole, as is done by *Tachysphex.* The latter insect, however, has the long-fringed fore tibiæ and tarsi, admirably adapted for digging in the loose, sandy soil (see fig. 81), while the heavy black earth in which *Notogonia* was working did not very readily permit digging with the feet, which in this case are not long-fringed (fig. 80). The immature *Gryllus* used were so young (or of a different species) as to be pallid beneath; darker, slightly larger *Gryllus,* as well as mature *Nemobius,* were scarcely noticed when thrown down before the very nose, so to speak, of the hunting wasp.

Ashmead (*Psyche,* p. 63; April, 1894) says: "In the south I have seen *Larra argentata* provision its cells with a small, immature cricket, which it completely paralyzes before storing it away in its clay cell. From a single cell I have taken as many as six of these small crickets."

Larropsis divisa Patton.

The females of the species of *Larropsis* were not found to be numerous in any locality, and consequently the method of searching their prey was seldom noted. At Leoti, Wichita county, August 19, 1910, at 8:53 A. M., one of these active insects was seen to enter its nest, which was situated at the upper edge of an old brick-clay pit, largely choked with Russian thistle. The entrance to the tunnel was by no means neat, and the insect had taken advantage of a small horizontal crack in the earth, as if to lessen the labor of excavation. *Larropsis* flew with her burden, which was evidently an immature *Ceutophilus* (Locustidæ, but rested several times *en route,* carrying the "cave" cricket well forward beneath her. Thus she entered the hole, very soon to reappear and take wing. Other *Ceutophili* were brought in at 9:06, 9:15, 9:35, 11:03 A. M., and 1:10

and 1:42 P. M. She returned empty handed at least twice between these hours, and sometimes remained a considerable time within her burrow.

An attempt to follow the tunnel failed. I should judge, however, that the affair was of good depth and several-celled. The wasp herself not being captured, her identity is uncertain, for besides *divisa*, the similarly colored but larger *aurantia* was taken in the same pit. At Kirwin, Phillips county, in August, 1912, however, the former species was seen to enter a hole the size of that made by a mouse. She reappeared very shortly, carrying a small *Ceutophilus* under her. Fearing to lose this wasp, she was captured.

The fact that at least some of the wasps of this genus occur very frequently about holes dug by animals would perhaps indicate that the "cave" cricket is the common food of more than one species. These Orthoptera fairly swarm in such retreats during the day, where they can often be seen congregated in numbers along the sides and ceiling. It is not improbable that the wasps commonly nest in the vicinity of some such hole, and that the lack of marked pilosity of the species of the genus *Larropsis* may be partly accounted for by their habits.

TACHYTES.

In comparison with the members of the genus *Tachysphex*, the actions of these wasps are slow. They do not run over the ground in such mad haste as do their smaller relatives, and excavate their burrows in a more dignified manner, pushing out the soil with the abdomen instead of throwing it out behind them in a stream like the *Tachysphex*.

Tachytes abdominalis Say.

My notes on this species are very fragmentary. The insect was not infrequently seen hunting her prey in moist places where immature Tettigidæ (grouse locusts) appeared to be the common object of pursuit; she was also seen in stubble fields, where she captured young *Melanopli*. The wasp moved rather slowly and often appeared to experience some difficulty in stinging her prey, due perhaps to the small size of the latter. I located a single nest of this species in Trego county, July, 1912, but failed to trace the tunnel for more than five inches, for which length it was approximately vertical.

Tachytes distinctus Sm. (Figs. 113-116, early stages and nest-mound.)

It was not until the summer of 1912 that I was able to locate the burrow of this large and common species. Many times had I watched her hunting her prey among the weeds, while on several occasions she was seen to pounce upon the immature acridian, but here my observations were ended, for *distinctus*, holding the locust beneath her,* would fly away and be soon lost to view. At times she would rise high in air with her burden before starting in the direction of her burrow, and again she would pursue her journey homewards at an elevation of only a few feet over the weeds. Her mode of hunting also was not uniform, for where one female would crawl over the vegetation, another examined the weeds while on the wing. Perhaps the latter mode is the more common in the species, and was well exemplified by a *distinctus*, which was seen inspecting a large patch of stinking clover (*Cleome*) for her orthopterous prey. The locusts on these weeds did not relish the presence of their fierce foe, and would oftentimes hasten behind a stem for shelter. Passing from plant to plant, however, she finally selected a good-sized *Melanoplus* nymph, poised briefly before her intended victim, and, pouncing upon it, dispatched it with her sting.

In Rooks county, northern Kansas, these wasps were abundant, and here several of their burrows were located. One morning, in early August, a *distinctus* was seen to fly with a heavy acridian to a hole in a sandy slope, and enter it with her burden beneath her. At this juncture I left the spot and did not return until 4 P. M. A short period after this hour *distinctus* came flying heavily, carrying beneath her a good-sized locust, venter up. She alighted heavily once or twice in the bush near by before entering her abode. Stopping up the entrance, I commenced digging with my trowel. The soil was rather loose and sandy, and moist to a depth of about six inches, where it was replaced by firm, black earth, and finally by a hard, dry stratum. The circular entrance to the wasp's tunnel was six-sixteenths of an inch in diameter and went through a heap of sand one and one-sixth inches high by two and fifteen-sixteenths inches wide at the base. The outer covering of this mound was composed of small, loose lumps, per-

* It may be said here that the wasp is quite particular as regards the method of carrying her prey. She sometimes fusses considerably before grasping it in the right manner, *i. e.*, holding the orthopteron's antennæ in her jaws and clasping the body beneath her with her legs.

haps recently thrown out of the nest; under this the soil was firmer, as though rain-packed. The whole affair had somewhat the appearance of a mud tube, such as are made by crayfish. The hillock is illustrated in figure 116. *Tachytes mandibularis* is reported by W. H. Patton to make similar tubes. I had not dug long before a confined, squeaky buzz was heard, and soon the proprietor was brought to light from a hole fully ten inches below the surface of the ground and fourteen inches from the entrance. The latter I followed, and found it to slant at an angle of about 60 degrees, the tunnel being lost before I reached any of the cells. About two inches beyond the wasp lay two nymphs of a species of *Melanoplus*. One of these had the long, curved *Tachytes* egg (fig. 113) transversely placed on the prosternum, its cephalic end secured in the membrane behind and somewhat inside of the base of one of the fore coxæ. I dug carefully for nearly two hours, during which time twenty cells and fifty-six acridians were found. The main shaft of the nest was soon lost, but the cells appeared strung along its length in a rather irregular manner. With the exception of the one in which the wasp was found, they were closed with earth. They were rather small and often very close to one another. The locusts were distributed in these chambers as follows:

2	cells	contained	1	acridian	each.
4	cells	contained	2	acridians	each.
10	cells	contained	3	acridians	each.
4	cells	contained	4	acridians	each.
20			56		

Fifty-one of the victims belonged to the tribe *Melanopli*, and of these only one was mature; the five remaining insects were small species of full-grown Tryxalinæ, viz.: four *Ageneotettix deorum* and one *Orphuella* near *speciosa*.

A few of the locusts moved their antennæ in a feeble manner, while with fresh specimens could be found others darkened and well on the road to decomposition. The cells were penetrable by a heavy rain, and in nearly every case contained a *Tachytes* egg or larva. Some of the latter were of good size; one seemed about two-thirds grown. The larvæ usually lay in a curve over their food. The freshly hatched specimens appeared much like the egg, in being of rather uniform thickness and showing very little indication of any segmentation. The largest larva, however, had deep intersegmental incisions,

a stout form, and some mammæ-like processes on the thoracic region (fig. 114). Some of the grubs showed a reddish hue through the thin skin, while several were quite green, the color being probably dependent upon that of the juice of the victim.

Two other nests of *distinctus* were located. One of these was but a few feet removed from the one just considered. There was no cone of soil surrounding the aperture as in the first case, but only a little heap of sand before it. The slope was about 40 degrees, and the tunnel seemed blocked for a distance of two and one-half inches down. Sixteen cells, containing in all thirty-eight locusts, were found. From one to five (usually two or three) were placed in each cell. The locusts were of the genera *Hesperotettix* and *Melanoplus*; one of the latter, a male *femur-rubrum,* was mature. The wasp, which I presently caught, was an old one, with noticeably frayed wings and the end of her abdomen coated with dried mud. Nest-building, however, had not progressed as much here as in the first case.

Shorty before 5 P. M. one evening a female *distinctus* was observed flying about an open area which was carpeted largely with buffalo grass. She would alight now and then to creep among the stems and roots, where she sometimes disappeared from view. At 4:55 P. M. she entered what seemed to be the commencement of a small hole, and began digging with a rather slow movement, emitting now and then the squeaky buzz common to these and many other Hymenoptera. In working she loosens the soil with her jaws, pushes it by with her fore legs, and finally shoves the earth outside with the end of her abdomen (this explains the frequently mud-covered pygidium), but never comes outside the hole with a load of dirt, as do some of the *Tachysphex*. Finally, at 5:23 P. M., she emerged, took wing, and with ever-widening circles disappeared. There was quite a heap of soil around the hole by this time, and much more by 8:35 the next morning, showing that *Tachytes* had done considerable excavating during the interval. I watched her bring in a small *Melanopli* at 8:43 A. M. At 11:53 I found the aperture blocked with soil, the wasp being at work within. On returning at 1:30 P. M. the hole was again open, and at 1:42, 1:52 and 2:17 I saw her bring in *Melanopli* nymphs, the hole being barely large enough to admit wasp and prey simultaneously. She then remained

inside for nearly an hour, perhaps making or closing a cell the while. I did not see her during the next two days. She probably met her death or deserted her nest, which contained but three cells. The soil here was of a rather hard nature; in consequence the tunnel was comparatively short. The first cell was five inches below the surface and five inches to one side of the entrance; the remaining two were not far removed from the first. The nest contained eight locusts (some of which were becoming quite moldy) and some small *distinctus* larvæ.

Tachytes distinctus must be ranked among the beneficial insects, preying as she does upon those most destructive Orthoptera which, though outnumbering these wasps very greatly, are checked to a degree by the combined forces of foes.

Tachytes fulviventris Cress.

This wasp was seen to store its nest with full-grown *Alpha crenulata* (Tryxalinæ), a small and rather fragile insect common on the high and dry plains of Kansas. The nesting habits were observed near the town of Meade, in the county of the same name. Here on June 10, 1911, a small colony of bright, fresh specimens was located. Their burrows were made in the mouth of a deserted prairie-dog hole, which was situated at the edge of a clearing surrounding the mound-nest of the agricultural ant (*Pogonomyrmex occidentalis*).

At 10:40 A.M. I noticed one of these wasps carrying her prey, venter down, beneath her, fly swiftly and directly to her tunnel, which she entered head first with her burden. The wasp held the base of the antennæ in her mandibles and clasped the locust's body with her legs. At 10:42, 10:44 and 10:48 A. M. other *Alpha* were brought in, probably by more than one *Tachytes*. In watching these several wasps a little variation in behavior was noticed. One wasp alighted near the burrow with her load before entering; another paused not at all, but flew to her nest with a high-pitched buzz and rushed in directly. Again one was seen to carry her burden on its side; the bearer in this case experienced some difficulty in finding the exact location of its burrow. While keeping a firm hold on the tryxalid, she flew about a small area and alighted once or twice before finding her abode.

Not being able to keep watch on this colony that afternoon, nor during the next day, the spot was revisited on July 12 (a

cloudy day), when three of these wasps were dug out of steeply inclined holes several inches in length. Two cells, seemingly the terminations of separate tunnels, were brought to light. The first contained four *Alpha* and one small wasp larva; the other cell revealed at least two *Alpha* and five fly maggots, somewhat larger than those of the common house fly. These soon pupated, but never produced adults. It is not improbable that the burrows of these wasps are several-celled when completed.

Tachytes mandibularis Patton.

This handsome species, with its decided buzz, was observed but once in capturing her prey. This was in the Saline river valley. The wasp was flying low over the weeds, resting now and then, examining plants, scrutinizing some with more care than others. Had it not been for her buzzing I would have soon lost her in her rapid flight. She finally pounced upon an immature locustid of green color, probably a species of *Orchelimum.*

Young Locustidæ being far less numerous than immature *Melanopli, Tachytes mandibularis* would usually have a more protracted hunt for her prey than her ally *distinctus.* Can the more sustained flights from plant to plant in the former species explain the stouter form and probably greater wing power of *mandibularis* over *distinctus*?

The large bembecid wasp *Stizus brevipenne* hunts in a manner quite similar to *mandibularis,* examining the stems of *Helianthus,* etc., as she flies and finally finds her prey, a large *Xiphidium.*

Tachytes obductus Fox.

This apparently rare little species frequented the muddy sand shores of the south fork of the Solomon river, in Osborne county. Here a few specimens were seen searching for immature Tettigidæ. The wasp runs over the ground at a moderate speed, stopping rather often to clean herself (this probably because of the moist nature of the sand). She was seen to capture her prey on two occasions. The grouse locusts were very small and easily borne away on the wing. No burrows could be located.

Tachytes mergus, also a rare insect and of swifter movements than her golden neighbor, had the same hunting grounds and probably the same prey as *obductus,* since Tettigidæ appeared to be the only suitable victims in the locality.

Tachytes obscurus Cress.

This wasp was taken but once with her prey—a very small acridian.

Tachytes rufofasciatus Cress.

This *Tachytes,* which has much the same appearance as *fulviventris,* was observed in Trego county, near those picturesque chalk cliffs which skirt the sandy bed of the Smoky Hill river. Here on July 13, 1912, several of these insects were watched hunting their prey along the edge of a dense and wide-spreading field of Russian thistle, dragging the victims a short distance over these weeds and then over the adjoining plowed ground to their burrows in the latter. The thistle supported an abundant population of largely immature *Melanopli.*

Early in the morning a *rufofasciatus* was observed flying from plant to plant and running hastily over the thistle tops in quest of her prey. At 8:18 A. M. she caught and stung a locust and dragged it laboriously over the disturbed soil to her nest. At 8:22 she secured another, with which it took her thirteen minutes to reach her burrow. Upon reaching the same she let go her prey, entered, and partly emerging head first, pulled it in by the antennæ. The wasp remained within forty minutes. This time was employed, perhaps, in closing a stored cell or in excavating another. She was off hunting again at 9:18 and five minutes later captured a small *Melanopli* nymph, with which she flew to her abode. This was the only instance in the locality where the smaller size of the victim permitted of its being borne away in flight. *Tachytes* was off again to the weeds, and at 9:55 pounced upon another *Melanopli* of a green color. She clung strongly to the dorsum of the struggling insect, and, stinging it under the thorax, soon quieted it. After biting (?) it awhile under the thorax she straddled the insect (which lay in an upright position), seized its antennæ near their base in her mandibles, and, holding the acridian as well with her third pair of legs, began her journey. Here she made use of her first two pair of legs and augmented her progress every now and then with a buzz of her wings. While in the weeds the heavily laden insect strives to keep on top of the Russian thistle, whence a leap (which she frequently essays in an effort to make better headway) often brings her only a little distance in advance and far down among the stems. Nothing daunted, however, she struggles to the summit of another plant, perhaps to repeat the performance. Several

other *rufofasciatus* were watched while stinging and transporting their prey. In two cases the latter were mature *Melanoplus* of about the size of a male *femur-rubrum*—heavy burdens indeed for these wasps. The larrids frequently hunted at about the middle height of the thistle, where, though at times lost to view, they could be heard colliding with the plant. In seizing her intended victim she seemed to forget all else, and the pair often fell to the ground during the struggle. The locust once overcome, the wasp does not delay the journey nestwards for long, nor does she always rid herself of the dust incurred during the fray, as many other species of the Larridæ do with great care.

The wasp worked in a rather desultory manner during the later afternoon hours. One, which had the appearance of being very tired, was noticed hunting at five P. M. The day was exceedingly warm, and *rufofasciatus* did not appear to relish the task of dragging her prey over the dry and dusty field, which offered numerous impediments to her progress in the form of a multitude of furrows, loose, shifting soil and other irregularities. Often, indeed, would the tired wasp gain the summit of some small ridge, only to tumble headlong with her prey into the furrow which she had but left. Thus covered with dust, the weary insect would sometimes abandon her prey and fly up in the air in a slow manner. Small parasitic flies sometimes follow these and other wasps in hopes of depositing their young, at a favorable opportunity, upon the captured acridian. Madame Wasp, however, is not always unmindful of the presence of these pests, for once she was seen to make a short dash at the dipteron, and turning again from her work, regard the unwelcome insect.

I attempted to dig out three burrows, but owing to the loose and unstable character of the soil met with no success. There was little or no evidence of a soil heap before the tunnels, which might lead one to infer that the wasp did much tamping and pushing and but little ejecting of the soil. The nests are probably several-celled.

TACHYSPHEX.

These comprise a goodly number of small or rather small wasps, largely cursorial in habits. They are much less pilose than *Tachytes*, and are exceedingly active in their movements.

Tachysphex fusus Fox and *terminatus* Smith.

Though neither of these red-tipped species was rare, little was noted of their habits. A *T. fusus* was taken in the town of Pratt, in southwest Kansas, endeavoring to fly from the cement walk with an immature *Melanoplus,* somewhat larger than herself. In Ness county, another of these wasps, having dug her nest in a nearly vertical bank of earth, stored it with two immature Tryxalinæ. The hole was two and one-half inches long and contained a single cell. *Terminatus,* which is very closely related to *fusus,* seems to have about the same habits as the latter, being taken once with a young tryxalid. A *Tachysphex,* which had the appearance of being either of the above species, was noticed nesting in the sand, in Graham county, August, 1912. She had evidently closed her burrow before going to the hunt, for I arrived in time to see her open it and enter, to reappear immediately to reach for a very small acridian which she had deposited before the hole. This orthopteron completed the store of provender, for she commenced filling up the burrow. At this juncture a small velvet ant (*Mutilla*) was attracted to the scene of operations, and lingered about the nest. *Tachysphex* did not appreciate the visitor, for she would approach this hard-shelled insect, and to all appearances try to bite it. When the latter ventured to enter her partly filled tunnel she would assist *Mutilla* in no gentle manner to make her exit therefrom. The hole was at length filled without accident, and, smoothing over the site, the wasp took wing. The tunnel was the usual short affair of the genus *Tachysphex,* its single cell containing several acridians of very small size.

Tachysphex plenoculiformis Williams.

It was early one hot July afternoon in 1911, in barren Haskell county, that this rather diminutive new species was seen to alight on the sandy soil, holding under her body a very young tryxalid locust. Thus burdened she ran into a hole near a small plant of Russian thistle. She did not tarry inside, but was out in a minute or two, and after circling about a little flew afield. At 1:41 P. M. she returned, to all appearances empty-handed, but decidedly immature tryxalids were brought in on the wing at 1:47, 1:51, 1:58 and 2:08 P. M. In every case but one (when she released her burden to rest for a short time) she flew directly to the tunnel with her prey. At 2:13 she commenced to fill the burrow from within, backing

in, and at the same time directing a load of sand inside. Now and then she interrupted her labors by flying to an adjoining weed and resting thereon for a very short time. When her work had the appearance of being nearly done she was captured and the nest dug out. The latter was about one and four-fifths inches long and one and two-thirds inches deep, and the rather enlarged terminus contained six young locusts, which exhibited signs of life by a very slight movement of their legs and antennæ. No egg was found, though it may well have been lost when I dug out the tunnel.

This small insect, with its quick flight and jerky motions, is quite difficult to follow, and flies to and from her nest in a manner that defies pursuit.

Tachysphex propinquus Viereck. (Fig. 112, wasp and prey.)

In the hot sandy country which borders the Cimarron river, in southwestern Kansas, this striking species was frequently observed digging her shallow burrow with nervous haste or running over the ground with wonderful agility in search of her prey.

The following notes, taken in Grant county at the end of July, 1911, should serve to illustrate the wasp's habits to a good extent. On July 26 at 10:41 A. M. I saw a little *Tachysphex* running over the sand. Coming upon a mature *Alpha crenulata* (Tryxalinæ) she pounced upon it and subdued it with a sting. At this juncture a small lizard spied the wasp dragging her booty, and hurried toward the pair. The reptile I frightened away, and likewise the *Tachysphex,* which never returned to her prey. Another wasp, however, was found near by, hunting. This was at 10:55 A. M. After a brief search, during which she ran and flew a short distance and explored the patches of short grass with due diligence, she captured and stung to helplessness an *Alpha,* the latter hopping manfully during the struggle. Then *propinquus* went off to one side, where she brushed and cleansed herself and rested for a short time. Then she placed herself astride her prey (which lay on its back), seized it by the base of the antennæ, carried it a short distance, to let go her hold to malaxate (?) her victim, remaining quietly over the latter with her mandibles opened to their full extent and appressed to the *Alpha's* neck, or head, the attitude suggesting that the wasp might be engaged in lapping up a fluid. She soon resumed her journey.

Resting now and then, she proceeded by active little jumps and very quick running and went directly into her hole, burdened as she was. She was soon seen working the soil downwards from inside, backing in and throwing in the dirt simultaneously with her long-fringed fore feet, at times vibrating her whole body longitudinally and swaying it, as described later in *tarsatus*. After working herself almost to the surface she did some leveling, attacking the remainder of the soil heap and directing the dirt toward the now nearly filled tunnel. At short intervals she turned around and looked briefly in the direction she had been throwing the dirt, as if to make sure that her efforts were being applied in the right direction. When she had nearly completed her work she was captured. The tunnel was in good sandy soil and located in a footprint.* The gallery was packed with soil down to the locust, upon which the long, curved egg was placed as usual. But a short time is required to dig the nest, and when she is nearly or quite through with this work she emerges head first, instead of backing out as is done when in the midst of her excavating.

Propinquus is not very select in choosing her prey, for in addition to *Alpha crenulata* as food for the grub, *Ageneotettix deorum, Mestobregma kiowa* and what appeared to be an immature *Opeia* were also captured. Some of these Orthoptera are giants in size in comparison with their captor; the latter frequently has a strenuous time of it in subduing and dragging them to her burrow. The locusts sometimes escape. On one occasion a *Derotmena,* having been startled by one of these wasps, spread out and elevated its bright red wings somewhat as an open fan, the insect thus presenting an unusual if not a startling effect.

The measurements taken of four tunnels are as follows: Length, 2½, 2, 3, and 2¼ inches; depth, 2, 1, 2, and 1½ inches.

Tachysphex tarsatus Say. (Fig. 117, egg.)

Rather extended observations were made on this persevering and industrious little insect. In a certain limited area in Meade county the burrows were scattered somewhat indiscriminately over the ground, and might thus be termed a loose settlement of *tarsatus*. The weeds were rather sparse here, making it easy for the observer to follow the actions of the

* It may be well to state that these wasps, as well as some of the Sphecidæ, seem to realize that the impression made by a foot or hoof affords an easy start in digging where the crust of soil is broken, and accordingly such spots are often selected.

insect. Her mode of procedure consisted in running very rapidly in a rather zigzag fashion (when she much resembled a male Mutillidæ, or velvet ant), with occasional little flying jumps, and more rarely with a lightning-like flight of a few feet, to a new hunting ground, when, as one would be led to believe, she deemed the old one explored or unproductive. The insect, as if mindful of the burden she must carry, does not wander far from her burrow.

One July morning at 9:15 A. M. I watched this little *Tachysphex* hunting. She ran rapidly over the ground, passing by the larger Acridiidæ, which would often lift up their legs in a threatening manner at the wasp's approach. An insect which she deemed unsuitable she would inspect with scarce a pause, but a desirable one she often pursued in flight. Every now and then she would stop and rest for a few seconds. Her powers of vision did not appear to be particularly good, for on occasions she passed within an inch or two of a terrified nymph, which, evidently aware of the nature of the hymenopteron, would leap away at her approach, dodge behind a plant stem, or lift up its defensive legs. This last action was more than a threat, for more than once have I seen a *Tachysphex* repulsed for a time by a well-directed kick from the frantic orthopteron. However, the aggressor would return instantly to the fray if her prospective prey had not already made good its escape.

At 9:27 A. M. the *tarsatus* under consideration, after a brief pursuit, pounced upon a *Melanoplus* nymph, clinging tenaciously to the same as it struggled, and finally quieted it with a sting under the thorax. After a brief pause, during which she cleansed herself and rested, she placed herself astride her heavy victim (which lay on its back), seized it by the base of the antennæ, and, using her first two pairs of legs for running, clasping her prey with the third, proceeded thus at a run, varied with a frequent buzzing hop, to her nest, about twenty feet distant. She overran her destination, however, by four or five feet, but retracing her steps soon located her burrow, placed the locust within, and very shortly after filled up the hole. Then she concealed the site to a fair degree, exhibiting less skill in this than the careful *Ammophila*. Her work was completed at 9:51 A. M., or twenty-four minutes after the capture of her prey.

I dug out this nest. It was a little more than one and one-half inches long and terminated not quite an inch below the surface of the ground. The tunnel was rather loosely packed with soil down to the *Melanoplus*, which lay on its back, quite immovable, its head toward the slightly enlarged end of the tunnel. A long, pale greenish and somewhat curved egg of *Tachysphex* was fastened transversely across the prosternum (fig. 117).

The habits of this specimen typically exemplify those of several other *tarsatus* observed. The tunnel, which is always dug before the hunt begins, is left open while *Tachysphex* is afield. It is of comparatively large bore, slightly inclined, and not more than two inches long. As a rule, a single locust suffices for one wasp grub in this species; I have never seen more than two acridians to one nest. Though more often the prey is one of the *Melanopli* (immature), Œdipodinæ as well as Tryxalinæ are also used. These are frequently placed immediately before the burrow, which the wasp first enters, to reach out again, seize the locust by the antennæ and drag it within. If the prey is quite small, and therefore not sufficient food for the wasp's progeny, two are used, in which case the tunnel may not be spacious enough to admit *Tachysphex* and victim together.

This insect, among others, suffers considerably from the attacks of a very small tachinid fly (*Diptera*), an exceedingly quick and watchful creature, which deposits her own young usually upon the food intended for the larrid grub, and as at least some of the tiny maggots are found, immediately after their deposition, on or near the wasp's egg, the latter is doubtless destroyed. Whilst a *tarsatus* was hunting, this minute dipteron was seen to follow her closely, alighting near by when the wasp rested, or poising directly behind her. The wasp's first search being fruitless, she returned to the burrow empty-handed. This seemed to suit the little fly, however, for she remained near the revealed hole while *Tachysphex* sallied forth again, this time to meet with success. As she was nearing her tunnel, astride her prey, a little fly flew out to meet and follow her. At the hole were two other similar flies, evidently in a state of excitement over the advent of the wasp and prey. The owner, depositing the locust before the entrance, immediately went within. At this juncture one of the tachinids alighted for a second or less on the thorax of the paralyzed victim,

which was quickly pulled into the burrow by the wasp, but here the two remaining flies followed within, and after a very short stay there came out. I examined the orthopteron as soon after this event as possible (probably within two minutes), to discover four very minute fly maggots on and about the larrid's egg.

In the case where *tarsatus* entered her burrow without any pause, carrying her prey beneath her, a fly followed her and did not tarry therein for more than a second or two. Failing on one occasion to viviposit on the orthopteron which *tarsatus* was dragging within her tunnel, the little tachinid balanced herself on the top edge of the hole and dropped one or more maggots directly in front of the opening. The wasp being within at the time, would, perhaps, in filling up her burrow, throw the maggots, along with some sand, towards the locust. It seems doubtful, however, if these larvæ would be able to reach the latter. Rapid as these wasps are, the flies are often able to follow them in their short, lightning-like flights.

In filling up her tunnel *tarsatus* occasionally produced a squeaky little buzz. She gets up on the mound of extracted soil and backs into the hole, throwing the earth therein with her fore feet, coming out now and then to get more soil. When the tunnel was nearly filled it was easy to observe in what manner the wasp works. Throwing in the dirt, she backs in and vibrates or shakes her whole body longitudinally against the latter, thus pounding in the soil with the tip of her abdomen. She would also sway her body from side to side while vibrating, with the evident purpose of embracing all the necessary area in the operation. This process reminds one of a minute steam hammer at work. As soon as *Tachysphex* deems the site of her burrow sufficiently disguised she takes wing, probably to repeat the oft tedious process of providing for her offspring.

Tachysphex texanus Cresson.

This insect, which bears a superficial resemblance to *tarsatus*, was seen but once, in Barton county, carrying her prey, an immature œdipode of very small size.

Atypical Larridæ.

We now come to what may be termed the atypical Larridæ, which differ from the true Larridæ (Larrinæ) in having three perfect ocelli. Less is known of the habits of this group than

of the Larrinæ, just reviewed. In addition to Orthoptera, Hemiptera and spiders are captured by certain of the wasps to be considered.

Lyroda subita Say.

Mr. W. H. Patton (Ent. News, III, p. 90; 1892) says, concerning this species: It "is peculiar for its nonfossorial tarsi, and its method of carrying *Nemobius*, which it catches to feed its young, is interesting. It holds the cricket by clasping the base of the antennæ between its mandibles and clypeus, the minute teeth preventing the antennæ from slipping; this explains the use of the teeth on the clypeus."

The Peckhams (Instincts and Habits of the Solitary Wasps) have observed that this insect uses small crickets to store her rather deep nest, and that she closes her burrow before seeking her prey. That she also feeds her young from day to day is also their belief.

L. subita was seen on a few occasions searching for her prey, traveling at a rather slow gait for a larrid, occasionally entering cracks or shifting her locality by a short swift flight.

Plenoculus apicalis Williams. (Fig. 120, larva *in situ*.)

This active little fellow (about 4.25 mm. long) was not uncommon in Phillips county during the latter part of August, 1912. Here a small sandy hollow in the midst of a sandy pasture furnished a fair supply of *Plenoculus*. The small, mat-like *Euphorbia* plants were quite attractive to the smaller Larridæ, while an occasional *Plenoculus* could now and then be seen running up and down the stalks of sunflower plants, as if engaged in seeking their hemipterous prey. Not far removed from this locality a broad and sandy pathway leading from "bottom land" up to the bluff, and possessed of a good, sunny exposure, was still more productive in this species of larrid, and here I was fortunate in observing a little of their nesting habits.

During the early part of the afternoon of August 31 two female wasps were seen storing their nests with mature as well as immature *Atomoscelis*, probably *seriatus* Reut. (Capsidæ), which they readily carried on the wing. The bugs, which are green and about 3 mm. long, were carried beneath the body of its captor, but just in what manner could not be determined. I watched one of these *Plenoculus* make four trips, bringing in bugs at 1:22, 1:25, 1:34, and 1:40 P. M., the

hole being always left open when the insect was afield. Catching the two wasps, I endeavored to dig out their nests. This proved to be a difficult task, owing to the sandy soil and to a severe shower which came up. The nest aperture was not neat, and the shaft sloping. The latter I soon lost, but a little later succeeded in running across several cells an inch or two beneath the surface, in firm, moist sand, quite warm in the afternoon sun. One of these chambers contained about six bugs, another five, and in all I obtained about thirty-four Hemiptera from this nest. The cells were at least six in number, rather large and well packed with victims, upon one of which was a half-grown wasp larva transversely arranged with its mouth parts in the skin immediately back of one of the fore coxæ.

The Peckhams (Wasps Social and Solitary, p. 95-6) found *Pl. peckhami* building her nest in the stems of raspberry bushes, partitioning its cells with earthen granules, which are later used by the larvæ in forming the case of the cocoon. As many as nine cells were found in one nest of this insect. It provisions the cells with immature bugs of the genus *Pamera* (Lygæidæ).

Niteliopsis inerme Cresson. (Fig. 119, egg *in situ*.)

Although this dusky little insect was not uncommon in certain localities, very little could be ascertained about its habits. Specimens were taken at Rush Center, Rush county, June 19, 1912, flying low and quite swiftly over hard, sparsely vegetated ground. They alighted but rarely. At Hays, Ellis county, about July 18, 1912, I located an *inerme* burrow in a small area of bare clayey soil. When I arrived on the scene of action she had already stored her nest and was filling the same with pellets of earth. With these she at first descended out of sight, but as the hole was being rapidly filled, she was soon exposed to view. She worked with great rapidity, flying to and fro a distance of a foot or less, selecting bits of earth. Fearing to lose her, she was netted before her work was completed.

The tunnel was neat and round, almost vertical, one and one-half inches long, and cohesively silk-lined for about half its length. I suspect its original proprietor must have been a spider. The bottom of the hole was not enlarged into a cell, but perpendicularly filled with five immature green Hemiptera of the family Capsidæ. One of these (fig. 119) had a large,

curved wasp egg transversely arranged and secured at its cephalic end behind the first pair of legs. The curve of this egg conformed rather nicely to the convexity of the bug's venter, and was stouter than the egg of either *Tachytes* or *Tachyspex*.

Niteliopsis fossor, a large species in another division of this genus, has been taken by Mr. Rohwer, of the United States National Museum, with an immature œdipode (Orthoptera). This wasp has not thus far been found in Kansas.

Miscophus Spp.

Nothing on the biology of our native species was observed; more is known of the habits of this genus in Europe.

Saunders (Hymen. Aculeata, p. 84; 1896) tells us that *Miscophus concolor* Dahlb. "provisions its nest with a small, white-bodied spider, which is found commonly on heath (Smith)."

Ferton (Actes de la Soc. Lineenne de Bordeau, XLVIII, 266-8; 1895) has notes relating to several species. *M. gallicus, niger, nicolai* and *bonifasciensis* were observed to store their tunnels (which were quite shallow and excavated in sand) with small spiders. From seven to twelve of the latter, which may belong to several families, were found in one cell of *M. bicolor*. The author informs us that *Miscophus* bears her paralyzed prey in her mandibles, and proceeds with little hops afoot, or with flying leaps. Sometimes she malaxates her prey, without doubt, as Ferton says, for the purpose of extracting a liquid ("pour tirer sans doute une liquid"). The spider may survive in a helpless state for as long as two months, as Ferton has shown. The cocoon is very strong and composed of agglutinized grains of sand.

Hartman, in his Observations on the Habits of Some Solitary Wasps of Texas (Bull. 65, Scientific Series, Univ. of Texas, p. 55-6; 1905) speaks of a *Miscophus* preying upon "young epeirids of convenient size. These are carried on the wing or afoot, depending on the weight of the victims. To quote this author: "This wasp grasps the paralyzed spider with her mandibles by two or more of its legs, slings it on her back and marches off with it, walking forward, the spider hanging rather to one side in an uncomfortable and rather awkward-looking manner." The nest is very small, one-celled, and, as in the European species, is closed while the owner is away.

Summary.

The Larridæ are very active insects; on the whole, more partial to sandy situations than to those having rich heavy soil. They are therefore more abundant in western than in eastern Kansas.

The males are frequently seen on flowers or basking in the sun. They were only observed to work when excavating short tunnels, in which they probably passed the night.

The prey of the larger wasps (Larrinæ) consists of orthopterous insects, of which more than one genus, or even subfamily, may serve as food for a single species. The prey of the smaller ones, having three perfect ocelli, seems to consist for the most part of hemipterous insects, although some use Orthoptera and a few Arachnida (spiders).

The Larridæ hunt on the wing or afoot, and may drag or even fly with their prey. The latter is frequently far larger than the wasp, and is subdued by a sting under the thorax.

The nests are almost always terrestrial, consisting in certain genera of one cell, in others of several, to many cells; they may therefore require from an hour or two to several days for their construction and provisioning. They are usually left open when the wasp is afield.

The egg of the wasp, with the exception of *Miscophus*, is placed transversely across the prosternum of the prey—a situation where it is unlikely to be injured.

The Larridæ suffer heavily from the attacks of small Tachinidæ, which follow the female to her nest and viviposit on or near the food intended for the young wasp.

Most frequently the insects nest in small, loose colonies. When nesting they are not usually timid, and can be studied from a very short distance.

The writer has found nothing in the habits of those or other Hymenoptera, however wonderful they may appear, that can be attributed to intelligence.

TABLE TO SHOW THE PREY OF THE LARRIDÆ.

Wasp.	Prey.	Order to which prey belongs.
Larra americana	Gryllidæ	Almost exclusively Orthoptera; the two exceptions(*) are Lepidoptera and Diptera.
Larra anathema (Europe)	Mole-crickets (Gryllidæ)	
Notogonia argentata	Immature Gryllus (Gryllidæ)	
Larropsis divisa	Ceutophilus sp. (Locustidæ)	
Tachytes abdominalis	Immature Tettiginæ and Acridiinæ	
Tachytes distinctus	Various Melanopli, M. femur-rubrum, usually immature; Ageneotettix deorum, mature (Acridiinæ and Tryxalinæ)	
Tachytes fulviventris	Mature Alpha crenulata (Tryxalinæ)	
Tachytes harpax	Xiphidium brevipenne (Locustidæ)	
Tachytes mandibularis	Xiphidium and immature Orchelimum,	
Tachytes mergus	Immature Tettiginæ (?)	
Tachytes obductus	Immature Tettiginæ	
Tachytes obsoletus (Europe)	Young Œdipodinæ	
Tachytes pompiliformis (Europe)	Immature Gryllus rufus, grasshoppers (Chortipus); lepidopterous larvæ*	
Tachytes rufofasciatus	Immature Melanoplus cyanipes, mature and immature Melanopli (Acridiinæ)	
Tachytes tarsina (Europe)	Immature Acridiidæ	
Tachysphex fusus	Immature Melanopli (Acridiinæ)	
Tachysphex hitei	Immature Litaneutria minor (Mantidæ)	
Tachysphex panzeri (Europe)	Acridiinæ	
Tachysphex plenoculiformis	Immature Tryxalinæ	
Tachysphex propinquus	Mature Alpha crenulata, Ageneotettix deorum and Mestobregma kiowa; immature Opeia sp. (Tryxalinæ and Œdipodinæ)	
Tachysphex quebecensis	Immature Acridiinæ	
Tachysphex semirufa	Immature Melanoplus spretus	
Tachysphex tarsatus	Immature Acridiinæ, Tryxalinæ and Œdipodinæ	
Tachysphex terminatus	Chortophaga viridifasciata immature Tryxalinæ	
Tachysphex texanus	Immature Œdipodinæ, flies (Diptera)*	
Lyroda subita	Nemobius; small crickets (Gryllidæ)	
Plenoculus apicalis	Mature and immature Atomoscelis sp. (Capsidæ)	Hemiptera.— Exceptions: (†) Orthoptera and Arachnida.
Plenoculus peckhami	Immature Pamera sp. (Lygæidæ)	
Niteliopsis fossor	Immature Œdipodinæ†	
Nitelopsis inerme	Immature Capsidæ	
Miscophus spp. (Europe and U. S.)	Various small spiders, Epeiridæ†	

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